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**More 386 Power:
PC Labs Tests 26
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JANUARY 15, 1991

THE INDEPENDENT GUIDE TO PERSONAL COMPUTING

VOLUME 10 NUMBER 1

**THE
BEST
OF
1990**

- ◆ 7th Annual Awards for Technical Excellence
- ◆ The Year's Top Products: Editors' Personal Picks
- ◆ Gaffe Riot: Bill Howard Savors the Year's Memorable Moments

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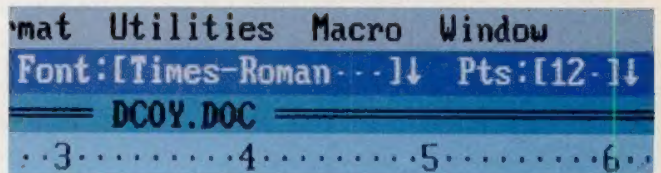
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Inside

PC Magazine's Seventh Annual Technical Excellence Awards take center stage in this issue, as we turn the spotlight on the products that truly advanced the state of the art in the past year. More important than the products, though, are those responsible for them. After all, without the scientists, engineers, and developers who have both imagination and the courage of their convictions to make their ideas reality, we'd have no technological breakthroughs to celebrate.

With that in mind, it's funny to contemplate the genesis of the Technical Excellence Awards. The idea for the awards came from editor-in-chief and publishing director Bill Machrone, whose goal was to see that the people behind the scenes got the credit they deserved—something that wasn't happening as often as it should have been. In fact, the very first awards carried the inscription "Unsung Hero."

Luckily, there's no need for such wording to be employed today. "The technologists in the industry have really become folk heroes," says Machrone, and they're getting the recognition they merit in the industry.

One important thing to remember about the Technical Excellence Awards is that they were created to reward technological successes, not merely commercial ones. "When we first in-



troduced these awards, we had the sense that most other awards were best-seller oriented. We don't have anything against that, but those awards don't tell the whole story, or underscore the real effort," says Machrone. "Best-sellers may include breathtaking technology, but sometimes they don't."

Best-sellers aren't necessarily found on the list of PC Magazine's Personal Best of the Year awards, either, al-

though they certainly may be. "The Best of 1990" focuses on the products that represent the year's *most useful* hardware and software offerings, without regard to the number of copies or units sold.

"This section is a powerful exception to PC Magazine's usual format," says executive

editor Bill Howard. "The Best of 1990 products reflect the skilled but individual choices of our editors or contributing editors. Aside from the columns, this is the one time in the year where we turn part of the magazine over to editors' individual preferences." You can trust that our editors have very compelling reasons for making these products their personal best of choices.

Also found in this issue is our annual...uh...tribute to the year's oddest oddities in the special "Abort, Retry, Fail?" feature; a survey of software menuing systems; and a roundup of 33-MHz 386s.—Jennifer Zaino ■



Editor-in-chief Bill Machrone instituted the Tech Ex awards seven years ago to celebrate innovative products and their creators.

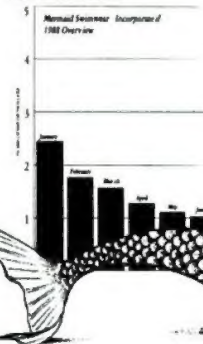
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Sales flounder early

To our shareholders:
Net income for Mermaid Swimwear Incorporated in 1988 increased 4% from 1987.

Highlights of Operations
The premier performer was a new line of MerMan and MerKut swimwear designed by Karina Zapata, a world-renowned designer of women's sportswear. This marked in the Northeast territory was the MerMajesty swimwear line, proposed by my wife. The line was only moderately successful, and the line was pulled from stores two weeks after its introduction. The company realized a substantial boost to profits from Group's Undersea Adventures, a subsidiary company specializing in cruise/cuba diving vacations. The firm's president and head cruise director, Rick Grouper, reported interest in this leisure activity is at an all-time high. He also noted that the business was not negatively affected when one of the firm's cruise ships, captained by a former crew member of an oil

tanker, ran aground and caused a huge frigate dague spill along the southern tip of Cuba. Setting New Courses In June of 1988 we acquired



Sales flounder early but surge in 2nd half

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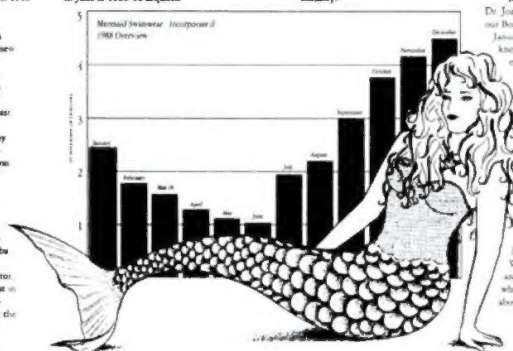
tanker, ran aground and caused a huge frigate dague spill along the southern tip of Cuba. Setting New Courses In June of 1988 we acquired

Bubba's Bar Camps. No other franchise of its kind exists, making it the leading company in the ever-growing recreational fishing industry.

Another significant move in 1988 was the acquisition of the largest surfboard company in Kansas, Wright's Wave Riders.

Addition to the board
Dr. Joan Smith was elected to our Board of Directors, effective January 1. Dr. Smith is well known for her therapeutic swimming exercise video. She's also a special consultant to the Russian Olympic women's swim team.

Outlook
Our 1987 performance again demonstrated that our strength lies in the bold, innovative marketing of our existing products, and diversification and acquisition of ancillary industries and other get-rich-quick schemes that promises exciting possibilities for immediate profits. With sound operations in place, and a diversified platform from which to grow, we are optimistic about the future.



Submitted on behalf of the Board of Directors
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Chairman of the Board and Chief Executive Officer

The QMS-PS 2220 lets you tell the whole story

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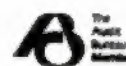
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PC MAGAZINE REVIEWS

Except where noted: All *PC Magazine* reviews are of currently available products. Comparative reviews are arranged alphabetically by product name for software, by company name for hardware. Software is free from copy protection. On benchmark test charts, shorter bars indicate faster products (less time to complete a task). Benchmark and performance tests are run on 8-MHz IBM PC ATs.





HIGHLIGHTS

- 800386 19MHz microprocessor
- 4 lbs. Total Weight
- 1Mb RAM (expands to 4Mb on system board)
- 20Mb Hard Disk Drive
- 1.44Mb Floppy Disk Drive
- Pre-Loaded with MS-DOS 4.01
- 5 1/2" Notebook Size
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AUSTIN 386/SX20 & 286/12 NOTEBOOKS

STANDARD FEATURES

- VGA Monitor Port for External Monitor, Printer Port, and 2 Serial Ports
- Modem/Fax Slot and RAM Expansion Slot
- Real-Time Clock and Calendar

KEYBOARD

- 82 Key Keyboard
- Full-Sized Embedded Numeric Pad with 12 Function Keys

VIDEO DISPLAY

- Brilliant 10" VGA Diagonal Display with 640 X 480 Resolution

OPERATION FEATURES

- Suspend/Resume Mode
- Video/Audio Low-Battery Warning Indicator
- Recharges with AC Adapter

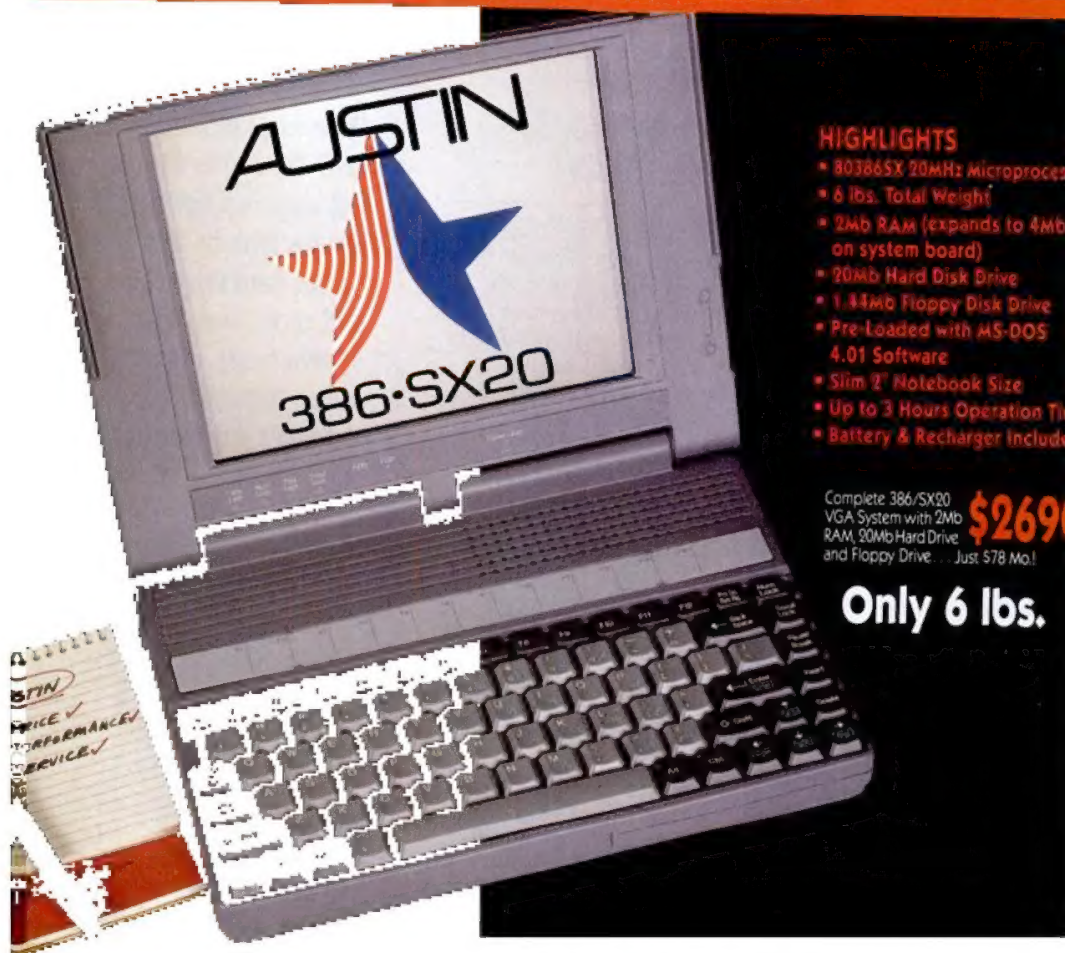
HIGHLIGHTS

- 80386SX 20MHz microprocessor
- 6 lbs. Total Weight
- 2Mb RAM (expands to 4Mb on system board)
- 20Mb Hard Disk Drive
- 1.44Mb Floppy Disk Drive
- Pre-Loaded with MS-DOS 4.01 Software
- Slim 2" Notebook Size
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HIGHLIGHTS

- 80386/DX Intel 25MHz Microprocessor
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- Super-Charged VGA Video Adapter (supports up to 1Mb VRAM)
- Pre-Loaded with Microsoft Windows 3.0 and MS-DOS 4.01
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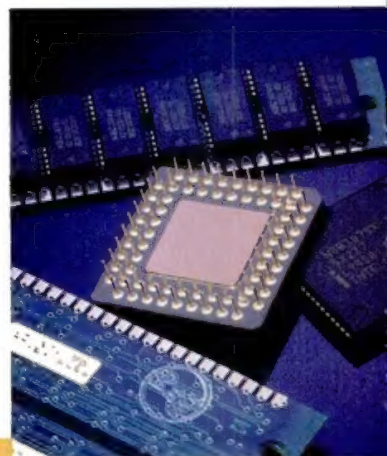
- Floppy Drive (1.44Mb or 1.2Mb)
- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- 7 Expansion Slots (1 8-bit and 6 16-bit)
- 80387 Math Coprocessor Socket
- 1 Parallel and 2 Serial Ports
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HIGHLIGHTS

- 80386 Intel 33MHz Microprocessor
- 4Mb RAM (expands to 32Mb on board)
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- Super-Charged VGA Video Adapter (supports up to 1Mb VRAM)
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- New Small Footprint Chassis
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AUSTIN 386/33 WINSTATION

STANDARD FEATURES

- Floppy Drive (1.44Mb or 1.2Mb)
- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
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- 7 Expansion Slots (1 8-bit and 6 16-bit)
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AUSTIN 486/25 WINSTATION

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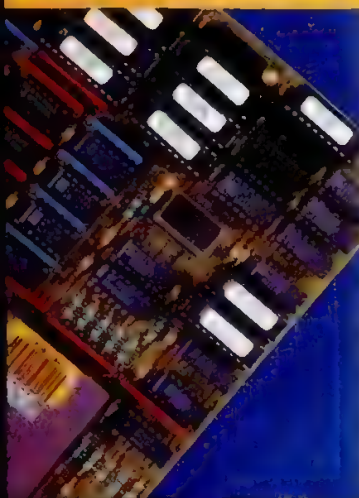
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Our Editor's Choice just got better! Now you get all the award-winning features... plus the new Microsoft Windows 3.0, MS-DOS 4.01, and even a Microsoft Mouse. Go with a real winner... the Austin 386/SX16!



HIGHLIGHTS

- 80386SX Intel 16MHz Microprocessor
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- Super-Charged VGA Video Adapter (Supports up to 1Mb VRAM)
- Pre-Loaded with Microsoft Windows 3.0 and MS-DOS 4.01
- Microsoft Mouse
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AUSTIN 386/SX16 WINSTATION

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- Floppy Drive (1.44Mb or 1.2Mb)
- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- 7 Expansion Slots (1 8-bit and 6 16-bit)
- 80387/SX Math Coprocessor Socket
- 1 Parallel and 2 Serial Ports
- Enhanced 101 Keyboard with Tactile/Click Touch
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- Other options are available. Call for details!

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"Austin Computer Systems is on a roll. The Austin, Texas-based computer seller has garnered PC Magazine Editor's Choice as if the award had been created for it."—PC Magazine, 09/25/90 Issue.



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- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- 7 Expansion Slots (1 8-bit and 6 16-bit)
- 80387/SX Math Coprocessor Socket
- 1 Parallel and 2 Serial Ports
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- Super-charged VGA Video Adapter (Supports up to 1Mb VRAM)
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- Microsoft Mouse
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FCC Class B

In *PC Magazine's* 386/SX-20 Editor's Choice review, they said, "The Austin 386/SX-20 PowerStation narrowly missed this award (Editor's Choice) because the FCC had not yet granted it Class B status..." Well, guess what! We've got it now!

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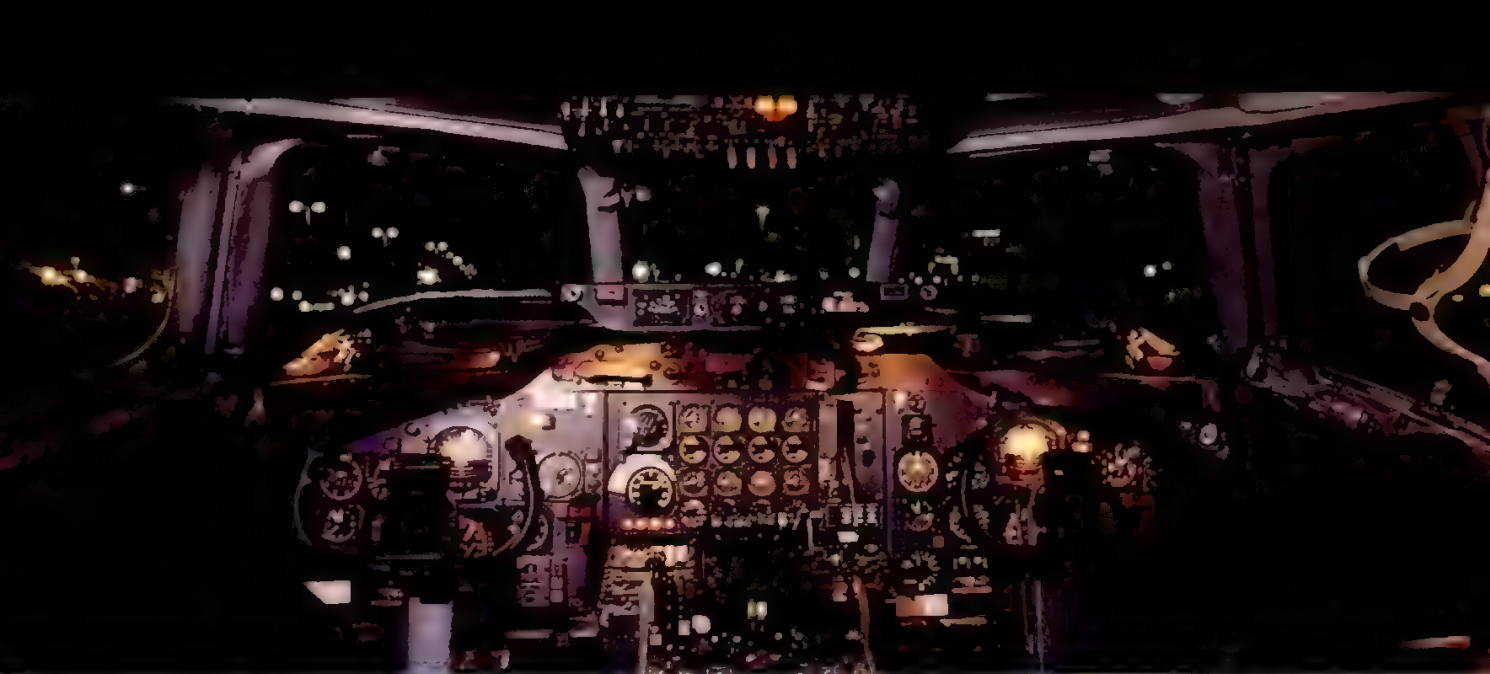
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Sure, you want to get your PC flying. With features like multiple open applications and background printing. Maybe even the ability to maintain your host connection while you work on something else.

But for that you need Windows or OS/2. Which means you also need to learn enough to get a pilot's license. And spend enough on hardware and software for a down payment on a jet.

But with new Software Carousel, you can get the biggest benefits of Windows and OS/2 by doing almost nothing.

It's #1 in task switching software.

Software Carousel got to be a best-seller because it works. Simply and reliably. Day in and day out.

And because it gives you the single most practical and powerful function of OS/2 and Windows—the ability to quickly switch from one application to another.

Simply load your programs as usual in individual Software Carousel work areas (it handles up to 12). Then switch instantly from one to another with just a keystroke. Each program gets as much RAM as it needs. And all your programs look and act just like they always did.

Best of all, nearly any program that now runs on your PC will work with

Software Carousel. Even RAM resident utilities, graphics programs and network software. And Software Carousel works on all types of PCs. So you can have the kind of multi-application capability you want, without buying anything new.

Now with Print'N'Run.

Thanks to Print'N'Run, new Software Carousel is also an advanced print handler. One that quickly takes over your printing jobs by accepting all the output bound for the printer, then sending it to the printer as fast as it can take it.

While your printer keeps running, you can keep working in the same application. Or switch to another Software Carousel work area running a different application.

No more wasted time waiting for your printer. No more lost productivity.

OLE. A network idea whose time has come.

OLE is the optional Open Link Extender* for Software Carousel. And it could be the best thing to happen to networks since OS/2 itself.

With OLE and Software Carousel, you can connect to

any host or service over a network—whether it's a mainframe, a mini, etc.—then “switch away” to work on another application, and not lose your connection.

OLE even makes sure that incoming data is received, even though your PC may be occupied with another application.†

And OLE works with all kinds of connection software. Including IBM, Attachmate, and others. Without changes to your hardware or software.

Even the experts agree.

Garry Ray, writing for PC Week, said, “Of these alternative operating environments (OS/2, DesqView and Software Carousel), Carousel may be the best choice of the day.”

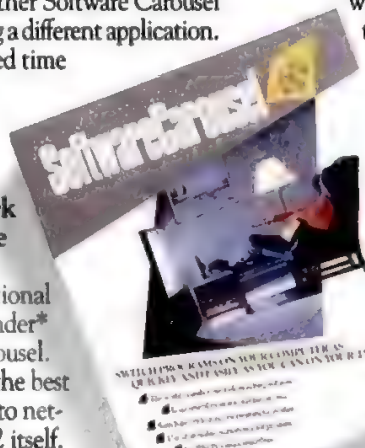
Barry Simon of PC Magazine concurred with, “... I find it difficult to imagine using my computer without Carousel.

This package has become an essential tool and one that I strongly recommend.”

So if you really want the major benefits of Windows and OS/2, don't get grounded with high cost and mind-bending complexity.

Take off today with Software Carousel. It's easy. And it's just \$89.95.

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Software Carousel \$89.95

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SOFTLOGIC SOLUTIONS

Letters

■ HOW RELIABLE ARE WE?

Your special issue on service and reliability (September 25, 1990) confirmed something I've suspected for years. That is, computers are like religions—people almost always believe theirs is the best.

How else to explain why more than 80 percent of your survey participants said they would buy again from the same company even when, in some cases, more than half of them reported experiencing a problem in the past year?

Steve Stecklow

Cambridge, Massachusetts

Your Service and Reliability survey is destined to be a sellout and a classic. However, I was surprised and puzzled to note that some bar graphs used a 40 to 90 percent scale rather than the 40 to 100 percent scale. This gives the visual—and false—impression that those items, such as 386SX machines, have superior ratings. An honest oversight, right?

Thomas G. Gass

Royal Oak, Michigan

Your ambitious satisfaction poll is commendable but may not be the last word on reliability. When you think you are measuring reliability, you may actually be measuring popularity. Fans of particular equipment may be more likely to send in a survey form. This effect potentially biases the survey results.

There are a number of reasons for liking a company's products, including advertising, brand loyalty, peer pressure, and quality. Your readers should be cautious when interpreting the meaning of your reliability scores.

Dave Bodycombe

Edgewater, Maryland

You really outdid yourself with your Service and Reliability survey. Having just parted with \$3,500 for a 386 system, I found your comments most welcome.

In general, I find your magazine the slickest, best written, and most useful



publication for any avocation I've ever known. Too bad I missed Dvorak's act here in Iceland.

Mike Schwartz

Reykjavik, Iceland

■ DVORAK BASHING

It was very disturbing to read John C. Dvorak's racist Japan-bashing article, "The Japan, Inc. Hoax" (October 16, 1990), which mixes inaccuracies with half-truths and truths.

I have lived in or traveled to Japan for 21 years. I have *never* gotten the scenic route from a taxi driver, unlike many tourists to American cities. Yes, Tokyo is poorly laid out, but what do you expect from a very old city that grew together from a series of villages? Has Mr. Dvorak been to London? Lower Manhattan?

Has Mr. Dvorak sought to escape traffic jams in Tokyo by taking the incredibly safe and efficient subways, which can be readily navigated using English-language maps available at his hotel? Or does Mr. Dvorak feel a tourist is safer or more likely to get better treatment from a taxi driver in the city of your publication (Manhattan)?

Most New Yorkers do not.

Let's give the Japanese credit where credit is due and get our own house in order before we bash the Asians who have neither forgotten the work ethic nor lost sight of the "American Dream."

Robert J. Schwartz

Scarsdale, New York

John C. Dvorak may have spent some time in Tokyo, but his October 16 column shows that he didn't learn anything. Tokyo cabbies, as a group, are quite honest. The reason they may have trouble finding someplace is the difficult address system, not a desire to pad the bill (the average Tokyo cabbie will refuse a tip).

Dvorak's description of the relationship between government and business in America (as opposed to the relationship in Japan), is superficial and grossly inaccurate. American businesses have time and time again shown that nearly all of them will do anything they think they can get away with in the name of profit. The image of American business as a lot of poor, picked-on poopsies is a conservative fabrication.

Edgar J. Lawrence

Dayton, Ohio

Unfortunately, Dvorak's columns used to be the first part of *PC Magazine* that I read. Lately, though, his columns don't have the zip they once had—there is something missing now.

Where yesterday he would write about some intriguing inside news of the industry and possible future trends, today he writes of copy protection and how the Japanese like to party after work.

C'mon, John, where's the beef?

Michael A. Yonker

Houston, Texas

■ COST JUSTIFICATION IS FOR REAL

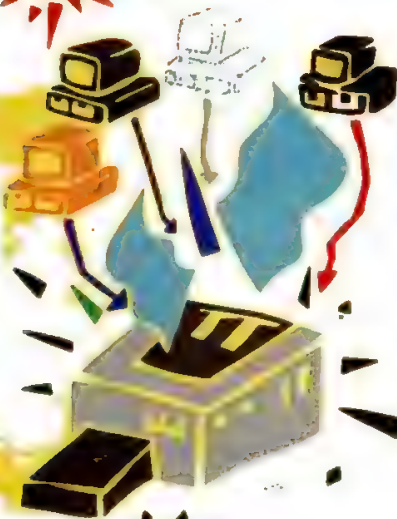
My compliments to William F. Zachmann (Cost-Justifying Computers, October 16, 1990). Cost justification has become a bad term in the industry for some

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CIRCLE 726 ON READER SERVICE CARD

Letters

reason. It appears that the micro-mania people think you're a dweeb if you believe in justifying hardware costs.

The prophets are telling us that old "techy" MIS directors like me had better become more business-oriented and less technical in the future or risk following the dinosaurs.

It's good to read something with a sense of sound business practices behind it. Most companies are not in business to provide storage space for microcomputer hardware, but rather to make money.

Fred Wilson
Providence, Rhode Island

TRUCK DRIVERS USE COMPUTERS, TOO

As an avid reader of your magazine, and of Jim Seymour's column, I can't help but feel that Mr. Seymour is way off base in his article "The 'Slate PC' Wave Is About to Break" (October 16, 1990).

As an independent distributor for a major snack cake company, I fall into the category of truck driving, blue collar workers who stock grocery shelves with bread and Fritos. However, I take exception to the notion that neither I nor my fellow workers are likely to use even the "slick-est" desktop, laptop, or even a palmtop.

The computer in my truck is used for printing invoices, ordering products, and maintaining customer databases and inventories. The one on my desktop is used for accounting, word processing, reports, and developing pricing strategies.

I am convinced that there are very few segments of the work force that cannot benefit from the development of computer technology, so don't sell us "truck drivers" short. We are not only using PCs, but we also subscribe to your magazine.

Michael R. Burwell
Ocala, Florida

WINDOWS VS. OS/2

Thank you for your comparative testing of *Windows* and *OS/2* ("Windows 3.0 Under the Spotlight," September 11, 1990). I theoretically concur with Charles Petzold's view that "Windows 3.0 May Be Neat . . . But *OS/2* Is Even Better" (page 202). News that IBM is working to slim down *OS/2* and speed it up is very welcome (Pipeline, page 63).

But it seems unlikely that many people

will go very far out of their way to obtain *OS/2*, and that is precisely what IBM and Microsoft are asking—not with RAM requirements, but with marketing strategies.

The installed population of AT clones (including SX- and 386-based) is huge. Anyone who buys a new system just to get *OS/2* from the vendor should have his or her head examined.

I shudder to think that the choice is between *DOS/Windows* and *Unix*.

Jim Howard
Project City, California

ANYONE WANT MY COPY OF WINDOWS?

I enjoyed your article "386 Multitasking Environments: Making *DOS* Work Overtime" (October 16, 1990). However, for me it was too late. I had already bought *Windows* 3.0, installed it, and subsequently removed it from my machine.

The hype surrounding *Windows* has to be the industry's stinkiest red herring to date, and *PC Magazine's* position on the matter is getting fishier every day.

In your Letters column (September 25, 1990) the editor says, "*Windows* is the most compelling reason we know to buy new hardware and software." I agree 100 percent: to get that thing to work to my satisfaction would require upgrading my 20-MHz 386 PC to a 33-MHz 486 with 8MB RAM and a 1-millisecond caching hard disk controller. And then I'd still have to go out and buy GUI software written only for *Windows*.

In the meantime, is anyone there interested in buying my copy of *Windows* 3.0? I'll put it toward buying *DESQview* 386!

Derek Hawkins
Astoria, New York

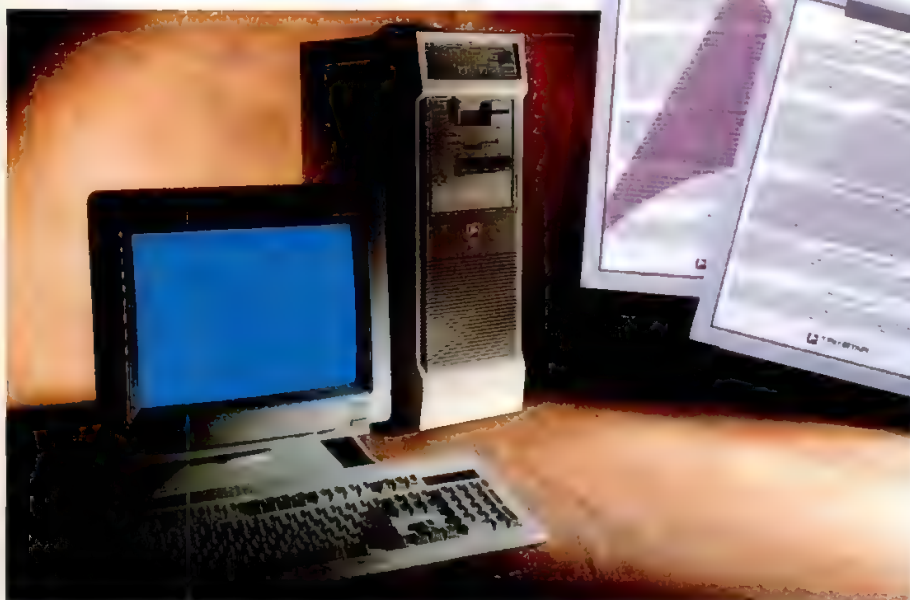
FREEDOM OF CHOICE

I read with disgust the letter from Lawrence Blume (Letters, August 1990) complaining about the new *Windows* column and *Windows* in general. I applaud your reply.

Why is there always someone ready to decide what others should be able to read or view? In answer to his assertion that it is a waste of space, I say, "so what?" The price of the magazine hasn't increased since the *Windows* column was added.

As for it being a waste of time, he need not waste his time reading it if he chooses not to. It's his choice. However, I'd prefer to choose for myself, as well, rather than have him, or others like him, make the choice for me by demanding that this or

One of the Most Important Components Built Into our Computers.



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PC MAGAZINE
JULY 1990



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ASTRONOMY IS
LOOKING UP
THE WEEKLY REPORT OF THE SKIES VOL. 8, NO. 4, FALL 1989

STAR SPORTS

Reported by The Star

Every day billions of dust particles enter in to Earth's atmosphere. New scientists are working to make re-

The Great Wall of China from the Moon?

Everyone has heard that you can see the Great Wall of China from the Moon. Or from Earth orbit. Or even from Mars. Certainly you cannot see the Great Wall from the Moon. According to

astronomers, it's difficult even seeing continents. You may be able to see the Great Wall from Earth orbit, but, in general, it's difficult even to see familiar objects the planet's small moon. *continued on page 2*

NO BLACK HOLES?

Scientists are still unable to confirm the existence of even a single black hole, despite widespread belief that such things should exist. Trapping down these invisible objects isn't easy, because they can only be studied indirectly by the effects they have on their surroundings. There are several types of places that

continued on page 2

MINOR, MINOR

It's a chore, but all reflecting telescopes require cleaning their reflective mirrors. Eventually, the aluminum coating on their mirrors deteriorates and needs replacing. For large instruments, the process requires removing the tele-

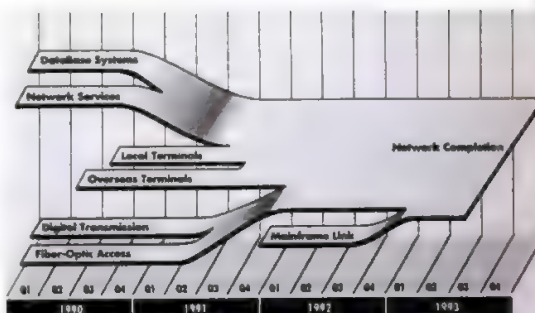
continued on page 2

Voyager's Last Picture Show

When Voyager 2 was launched 12 years ago, who could have imagined these photos of the giant in blue



LONGUST NETWORK INTEGRATION PROJECT



CHAIN REACTION
SCIENCE'S CHEMICAL NATURE

New Links to Solid Organic Chemistry

What's New in Superconductivity?

Antimatter Defined

Fifty Years Ago

Metal-organic chemistry bridges the gap between organic and inorganic chemistry. It can lead to important new products for a wide range of uses. A (include such as HFEA) shows reactions of hydrogen, nitrogen and nitrogen atoms can transport, and of metals and polymers from various sources. *continued next page*

It was almost exactly three years ago that a curious material that superconducts above liquid nitrogen temperatures was discovered. Within days of the discovery, scientists, general scientists, and transportation were being redefined in a new way. Yet superconductivity was not a new phenomenon. The effect was first observed in mercury in 1911, and, since then, more than 5000 elements, alloys, and compounds have been found to superconduct. *continued next page*

A device tested may give investigators a glimpse of what an antineutrino world might look like. The device made antineutrinos to a temperature a few degrees above absolute zero and stored it for several days at a time. *continued next page*

Remember how it was before WWII, our chemistry was so fundamental with a fast-changing process to know the colors of ordinary life? Abandoning the research at the start of world war, researchers then pursued the development of a stable C-14. Don't believe all rumors.

Introducing the new HP LaserJet IIID printer. The LaserJet that combines all of the advanced capabilities of the exciting LaserJet III with all of the paper-handling features required by today's busy office.

There's a lot to like. Like two paper trays for different types and sizes of paper. 200-sheet

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library of fonts and typefaces. You can even connect a Macintosh.

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From: Carol	05/23 09:13	Subject: Publication Meeting	
From: Carol	05/23 09:13	Subject: Conference Room 10	
From: Carol	05/23 09:13	Subject: For Review	
From: Carol	05/23 09:13	Subject: For Review	
Out Box			
Mail Message	05/23 09:13	Subject: V.P. Office	
Reply: William	05/23 09:13	Subject: Email Message	
From: Carol	05/23 09:13	Subject: Publication Meeting	
From: Carol	05/23 09:13	Subject: Conference Room 10	
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Letters

any column be removed.

Personally, I have no current use for the columns dealing with spreadsheets, databases, or networking, but you won't receive any letters from me asking that they be removed from the magazine.

Hal Scoggins
Missouri City, Texas

IT'S NOT EASY BEING A TASK SWITCHER

Many thanks for reviewing task switchers ("Task Switchers: The Hot Key to Fast Application Access," October 30, 1990) and our product *Switch-It*.

First of all I would like to reiterate M. David Stone's point that the life of a task switcher is not easy. A task switcher has to deal with so many different types and versions of hardware and software. Depending on a particular combination it may have different anomalies and compatibility issues. We work very closely with our customers in technical support to resolve any problems they encounter, and we

offer a money-back guarantee.

We could not replicate the files problem Mr. Stone pointed out and not a single customer of ours has reported the problem. The other problems that Mr. Stone described in his review also do not occur in Version 3.22, which is shipping.

Bharat C. Khatau
President
Better Software Technology



PC Labs tested Version 3.22 of *Switch-It* and found that the problems discussed in our review have indeed been corrected. —Ed.

IF I ONLY HAD A HAMMER, PART II

For the benefit of N.W. Miller and poor, misguided Jim Seymour (Letters, October 16, 1990), the "hammer" aphorism can be attributed to Abraham Maslow, who said:

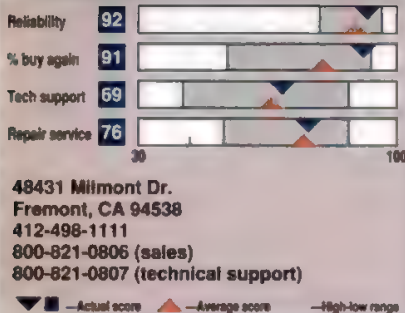
"If the only tool you have is a hammer, you tend to see every problem as a nail."

Come on, Mr. Miller, as Oscar Wilde said, "Seriousness is the only refuge of the shallow."

Bill Wilson
Hendersonville, Tennessee

CORRECTIONS & AMPLIFICATIONS

As the result of a production error, the incorrect company scorebox appeared with the Everex desktop PC review in our Service and Reliability special issue (September 25, 1990, p. 147). This is the correct company scorebox for Everex desktop PCs:



In the review of *VirtualVideo Producer*, (First Looks, October 16, 1990), V_Graph's phone number should have been (215) 399-1521.

In our Service and Reliability issue (Sep-

tember 25, 1990, page 376), there was an error in the review of Canon USA's printers. The article should have stated that in comparison with the 83 percent overall average of people who would buy from their companies again, only 72 percent of Canon respondents would.

Contrary to what was reported in the September 25, 1990, First Looks review, the SIP memory modules in the Ergo Brick SX are socketed, not soldered.

HOW TO WRITE TO PC MAGAZINE

We welcome your comments, complaints, insights, and suggestions. Please send them to Letters, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see page 8 for access information). All letters become the property of *PC Magazine* and are subject to editing for considerations of space and clarity. Please address all mail to *PC Magazine* with the proper department printed on the envelope so that we can quickly direct your letter.

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Keyboard: 101-key enhanced layout.
Video: 16-bit VGA adapter with 256KB RAM, expandable to 512KB. 14 inch VGA monochrome display.
 Call for information on our 486/25 EISA Desktop.



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STANDARD CONFIGURATION

Microprocessor and Main Board: Intel 80386 running at either 8 or 33 MHz. Main board has socket for Intel 80387 or Weitek 3167 math coprocessor.
Memory: 4MB standard memory, expandable to 16MB of 32-bit memory.
Storage: 1.2MB, 5.25 inch, high density, double sided diskette drive. AND 1.44MB, 3.5 inch, high density, double sided diskette drive. 200MB IDE hard drive.
Keyboard: 101-key enhanced layout.
Video: 16-bit VGA adapter with 256KB RAM, expandable to 512KB. 14 inch VGA monochrome display.



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STANDARD CONFIGURATION

Microprocessor and Main Board: Intel 80486 running at either 8 or 25 MHz. Main board accepts a Weitek 4167 coprocessor to coexist with the 80486's built-in math coprocessor.
Memory: 4MB memory standard; expandable to 64MB of 64-bit memory.
Storage: 1.2MB, 5.25 inch, high density, double sided diskette drive. AND 1.44MB, 3.5 inch, high density, double sided diskette drive. 200 MB IDE hard drive.
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For once, an announcement that will have businesspeople jumping into windows.

Until now, a lot of businesses have been hesitant to take the plunge into Windows. People have wondered, for instance, whether critical applications and viable communications would become available.

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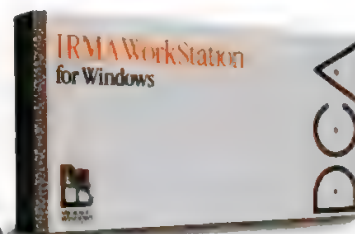
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PCM



CIRCLE 240 ON READER SERVICE CARD

by
Gus Venditto

Advisor

BAD SECTORS ON A NEW DISK

I recently purchased a 25-MHz 386 PC. When I received the unit, I ran *PC Tools* and *The Norton Utilities* and found that I had 130,000 bytes of bad sectors on my Seagate 65MB hard drive.

I called the PC company and was told by a technician that I shouldn't worry. He said that the number of bad sectors was impossibly small and that *all* hard drives have some bad sectors. Well, I realize that the bad area is minuscule but I paid for a new, unblemished hard drive, one *without* bad sectors.

All the IBM machines I have worked on have had flawless hard drives. Is this technician's general declaration designed to get customers to stop pestering the company?

Andrew Rosi
Vineland, New Jersey



Don't blame the technician for being honest. Most hard disks have surface flaws and 130,000 bytes is a modest amount to lose in a 65MB disk.

Those IBM hard disks you worked with in the past very likely had a similar number of bad sectors, but once the low-level format locked them out, IBM's disk BIOS kept that information a secret from DOS.

You may come across a truly perfect hard disk some day, but until you do, there's no reason to be concerned about surface defects that consume less than one percent of the disk.

BACKUP SOFTWARE DMA SPEEDS

After upgrading from a 10 MHz 286 to a 16 MHz 386SX, I've noticed that I can no longer use the fastest speed of my backup program. I seem to recall that the speed depends on a machine's DMA capability. Can I remedy the situation by getting a new driver controller or is it something that can be replaced easily?

Joe Emenaker
San Luis Obispo, Calif.

■ **BAD SECTORS ON A NEW DISK:**
Should a new disk come with surface defects?

■ **TRACKING TIME SPENT INSIDE PROGRAMS:**
Logging in the hours and the minutes.

■ **BACKGROUND FILE COPYING:**
Software that copies in the background.

■ **MEMORY-RESIDENT DICTIONARIES:**
Pop-up spelling help.



The most common reason why a fast computer will operate at low speeds on a backup program's DMA test is the presence of a SCSI drive. The DMA tests look at a PC's bus but it can be confused by the SCSI device because it adds a separate bus. If you have a SCSI device, don't be concerned; it may say "Low DMA speed" but it will be moving data faster than your old computer did.

If you don't have a SCSI device, and you're using *FastBack*, you should call Fifth Generation's support line; they have a DMA fix for some computers that operate at low speeds.

TRACKING TIME SPENT INSIDE PROGRAMS

My wife and I use our home computer—a Dell 310—for a variety of professional, financial, business, and personal tasks; for tax purposes, we need to keep track of our individual usage in each of the various categories.

We have been keeping a paper log, entering the data weekly into a *Quattro*

Pro spreadsheet for analysis.

Surely others have faced this problem, and software must be available to simplify and automate the task.

John Wetzel
Urbana, Illinois



Over the years, many people have used DOS batch files that would note the time an application was launched and the time they left. See the April 12, 1988, User-to-User column for an explanation of how such a batch file could be created for your own needs.

Of course, this kind of solution is crude and won't give you tools for totaling the time spent and assigning that time into categories.

TimeSheet is a tracking system that creates reports on individual clients and categories, after you've entered the amount of time spent on an individual project. (Software Partners Inc., Palo Alto, Calif.; 415-857-1110; \$149.95).

Timeslips 3.0 is a memory-resident tracking system that will give you all the features you need to track, to the minute, the amount of time you spend on a client. It will pop up an entry form so you can "turn on" tracking for any of 250 clients; if you get interrupted with a phone call, you can turn off the tracking for the client and turn on a different client.

For personal business, you can set up "home management," or "investment management" as clients. *Timeslips* will even let you export the summary reports into a file that you can merge with your existing *Quattro Pro* spreadsheets. (Timeslips Corp., Essex, Mass.; 508-768-6100; \$299.95).

BACKGROUND FILE COPYING

I'm looking for a program that will copy files in the background. I have one that will format disks in the background, so it seems there should be one out there that will copy files unattended.

Sgt. John Meyer
APO, New York

Advisor



We published such a utility in the January 17, 1989 installment of the Utilities column. It's called BCOPY and was written by contributing editor Doug Boling.

You can download BCOPY from PC MagNet; see page 8 for help in logging onto PC MagNet.

MEMORY-RESIDENT DICTIONARIES

Is there a TSR spell-checker/thesaurus program that pops up anywhere in DOS and works just like a pocket spell-checker? If there is, how RAM-hungry is it?

Shozo Yoshihara
Mississauga, Ontario
Canada



As yet there's no spell-checker that operates as a true TSR.

You can get most of the features on your shopping list, with the exception of spell-checking a document. Memory-

**The American Heritage
Electronic Dictionary
offers almost everything
you want.**

resident spelling programs can spell-check one word at a time, not a whole document.

And with the leading word processors adding spell-checking as an option, don't expect to find a program that will proof-read a document in the narrow confines of TSR. Since a TSR spell-checker would have to understand the hundreds of different formatting codes it would encounter while proofreading and still fit on top of various word processing programs, I doubt such a program will ever exist under DOS.

Grammatik, a leading style and spell-checker, has a hotkey mode that can be activated on top of some word processors, but it's really loading the entire program on top of a preselected word processor,

and is not available on top of other programs.

The American Heritage Electronic Dictionary offers almost everything you want: it pops up a dictionary listing for any word you highlight, and will find a synonym using *Roget's Thesaurus* as the underlying database. It uses up 140K of memory but does not spell-check documents, only individual words. (Houghton Mifflin Co., Cambridge, Mass.; 800-633-4514; \$89.95).

Language Master (Franklin Software, Fort Lauderdale, Fla.; 800-543-3511; \$99) does the same thing in 100K of available RAM, but its dictionary has only 80,000 words, while *The American Heritage Electronic Dictionary* has 116,000. *Language Master* uses the same dictionary offered in other Franklin pocket dictionary products.

ASK THE ADVISOR

Send your questions to PC Advisor, One Park Avenue, New York, NY 10016 or upload them to PC MagNet (see the instructions for joining on page 8 of this issue). Sorry, but personal replies are not possible.

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First Looks

Hands-On Reviews of the Latest Products

IBM PS/2 Models 90 and 95:

Upgradable 486 Architecture, XGA Graphics and SCSI Adapter

HANDS ON
by Winn L. Rosen

IBM's new PS/2s—Model 90 XP 486 and Model 95 XP 486—are not just the top of the IBM line; they promise to be the first of a series of market-topping PCs. Using two almost heretical chassis and systemboard designs, the current incarnations are yeoman 486s—IBM's first computers truly designed for that microprocessor. But thanks to their upgradable architectures, these super siblings are not inherently limited to anything so modest.

From a performance point of view, Models 90 and 95 are hardly trailblazers, but they finally put IBM on a par with the fastest of today's 486s in CPU, disk, and video speed. They are easily good enough to rival any machine on the market today, although at a high cost. The least expensive, a 25-MHz version of the Model 90 with an 80MB hard disk, costs \$12,495. The most expensive, a 33-MHz Model 95 with a 320MB SCSI drive, costs \$17,745.

It's not speed but chassis style that distinguishes the Model 90 from the 95. The former is a desktop package measuring 5.5 by 17.3 by 17 inches (HWD); the latter, a tower measuring 19.5 by 8 by 20.5 inches (HWD). The Model 90 offers four Micro Channel expansion slots, three of which are available for expansion once all the standard equipment is packed inside the chassis. The Model 95 offers eight slots, six of which are available, and each



slot has the capability of holding boards that are somewhat larger than those accepted by previous PS/2 designs.

The Model 90 has three 3.5-inch drive bays (two factory-filled) and one 5.25-inch half-height bay. The Model 95 holds two 3.5-inch bays (one filled) and five 5.25-inch bays (one filled). The 5.25-inch bays can be put to use by IBM's new internal "slim-high" 5.25-inch floppy disk drive, a \$310 option for either system. New setup procedures allow any disk in the system, including the add-in 5.25-inch unit, to boot these machines.

The cabinets of both the Model 90 and Model 95 mark a reverse of IBM's "the future is plastics" philosophy. They are made almost entirely of steel. Only the front bezels and a few internal pieces are plastic moldings. The end result is a pair of machines with great mechanical integrity and interference resistance.

But the most remarkable design change is IBM's abandoning of its traditional single-

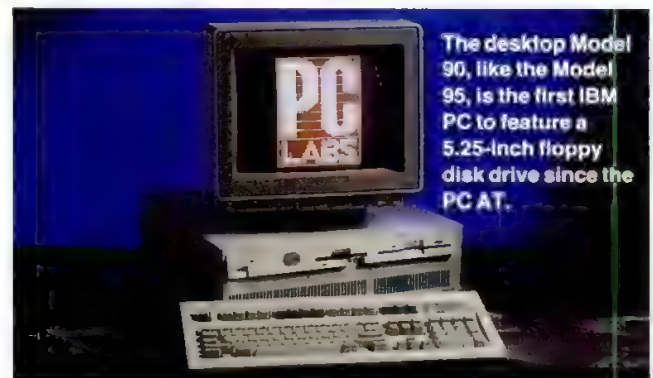
board computer design for a modified passive-backplane. The Micro Channel slots in both machines are little more than wires linking the expansion connectors together. The systemboard circuitry offers nothing but support—the standard input/output ports (keyboard, mouse, one parallel and one serial in the Model 95, two serial ports in the Model 90), plus video, memory, and floppy disk control circuitry sufficient for two drives.

The important stuff—the microprocessor, its associated circuitry, and the Micro Chan-

nel bus logic—are all held on a single proprietary expansion board that IBM calls the Processor Complex. IBM currently offers one of two processor complexes in the new PS/2s—a 25-MHz 486 or a 33-MHz 486. Upgrading from the slower to the faster board costs \$2,500.

To enhance the performance of those admittedly quick microprocessors further, you can attach a 256K RAM cache to the processor complex as a daughtercard. Without that \$1,995 add-in, either processor com-

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PS/2

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plex relies only on the internal 8K cache of the 486 microprocessor.

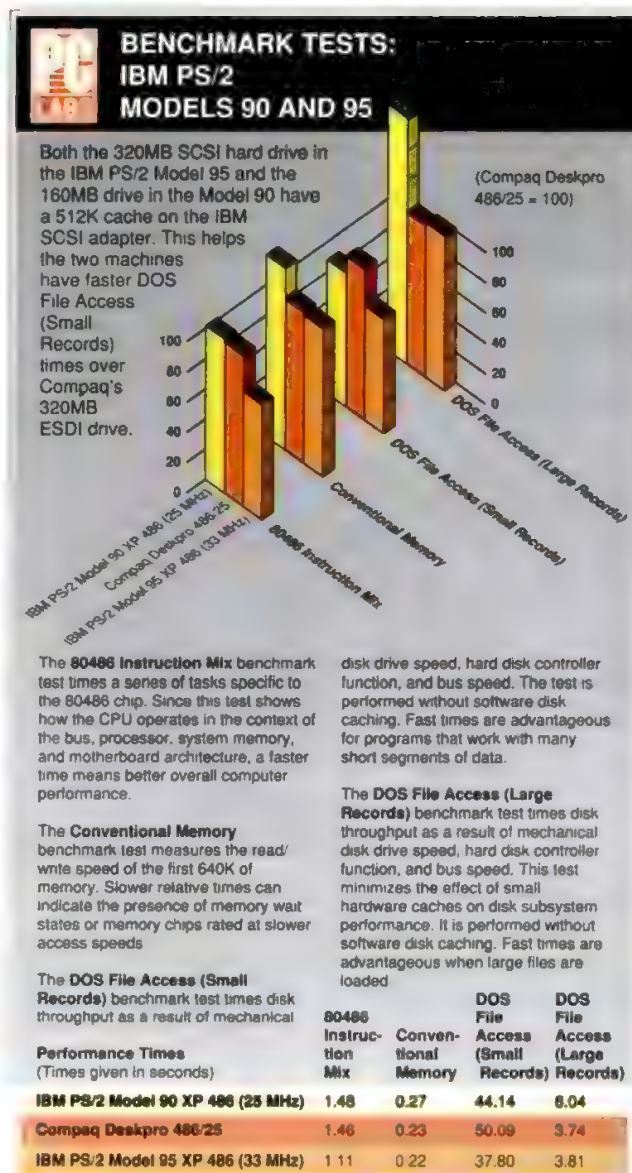
Standard memory in either of the new PS/2s is four megabytes. According to IBM, all of this is installed as SIMMs in eight system board SIMM sockets. While that's indeed true for the Model 95, the Model 90 comes equipped with two proprietary memory daughtercards to hold the SIMM sockets and installed memory modules.

Both systems are equipped from the factory with 70-nanosecond proprietary SIMMs (they will also accommodate 80- and 85-nanosecond SIMMs but with slower overall performance). Either system will automatically configure itself for any mix of 1-, 2-, 4-, or 8MB SIMMs (when the last become available) provided the modules are added in pairs to satisfy the requirements of memory interleaving.

The processor complex connects with the systemboard and memory through a 64-bit interface using a new Micro Channel connection that runs almost the full length of the processor complex. To cope with the inordinate insertion force required by this connector, plastic levers are provided on the board for forcing it into its socket.

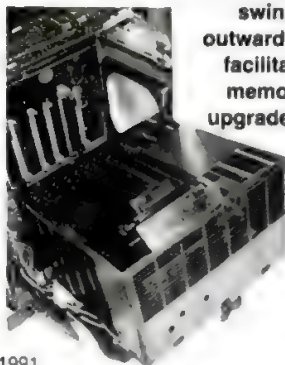
For mass storage, IBM supplies its 32-bit bus-mastering SCSI host adapter and a matching SCSI hard disk. Three capacities are available for different system models: an 80, a 160, and a 320. The Model 90 also features two connectors for IDE drives that are currently unexploited. Although *PC Magazine's* BIOS-based benchmark test speeds are obscured by the SCSI interface, DOS testing shows the drives approach the speeds claimed by IBM—as fast as a 12.5-ms. average access time for the 320MB drive.

Neither of the new machines exploits the full potentials of SCSI or Micro Channel technology, however. The IBM hard disk host adapter lacks the fea-



tures of the new SCSI-2 standard, and the Micro Channel slots lack the streaming data mode and multiplexed data transfers that are part of the so-called Micro Channel/2 specifications.

The Model 95's power supply swings outward to facilitate memory upgrades.



All standard expansion slots in the two machines do, however, offer a full 32-bit interface. One slot in the Model 90 and two in the 95 (one available) include the Micro Channel video extension.

In both the Model 90 and 95, the standard video system is IBM's new Extended Graphics Array or XGA (see sidebar). Backwardly compatible with VGA at the hardware level and the 8514/A software interface (but not hardware), XGA can put images with resolution up to 1,024 by 768 pixels in up to 256 colors on interlaced monitors equivalent to IBM's 8514 or 8515. While the XGA circuitry is part of the Model 90 system-

board, in the Model 95 it is packaged as a Micro Channel expansion board—the XGA Display Adapter/A—and sells for a list price of \$1,095. Standard XGA memory is 512K, which allows 16 colors at full resolution. Getting the full spectrum requires an additional 512K, for which IBM charges \$350.

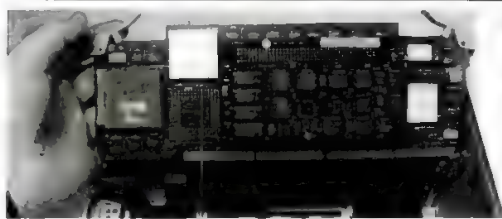
Because of its automatic monitor-sensing abilities, XGA will work with color or monochrome VGA monitors as well as high-resolution displays, automatically adjusting its palette and resolution to match. The most remarkable part about XGA in the Models 90 and 95 is that it operates as a bus master, handling the overhead of memory transfers itself. The result is that XGA display times don't vary much with microprocessor speed.

Another innovation in the Models 90 and 95 is that the serial and parallel ports of the systems operate as direct memory access (DMA) devices. These relieve the system microprocessor of memory management overhead. Consequently, they can achieve higher speeds while allowing better overall system performance during their operation. For example, IBM's supported serial port speeds now range from 300 to 345,600 bits per second, up from the 19,200-bps maximum of previous PS/2.

Although the advanced bus-mastering and DMA features of the new machines may not benefit DOS-based systems, they should help improve the performance of IBM's slimmed-down OS/2, Version 1.3, which was announced at the same time as the Models 90 and 95. Both a Standard Edition and Extended Edition of OS/2 1.3 (which each include the graphics-based Presentation Manager front end) are able to run in as little as 2MB of RAM.

In the Models 90 and 95, IBM has subtly reworked much of the original PS/2 design. While both machines use a software configuration scheme similar to that of earlier PS/2s, the necessary code is not contained on a special Reference Diskette. Instead, it is hidden on a 3MB reserved area of the system's

First Looks



In a break from tradition, all Micro Channel Intelligence resides on IBM's Processor Complex.

principal hard disk, along with diagnostics and even part of the system BIOS. While this is the functional equivalent of putting setup code in the system ROM, it offers more storage and allows for relatively thorough and user-friendly setup procedures. The configuration firmware/software, and the system BIOS, can be easily updated since no ROM swaps are necessary.

The individual parts of the machines are fascinating, but the overall approach of the systems is even more intriguing. The power platform design will allow IBM to update these systems to higher-performance microprocessors—say, 50-MHz 486s or 586s. The sturdy steel cases won't have much trouble passing government muster. Moreover, because the bus control logic is on the processor complex, IBM can add all the advanced Micro Channel features it left out this time around when it needs to eke more speed from the bus. Not only will the ability to swap processor complexes help preserve some investment in the new PS/2s as

technology changes, it could also help IBM become more of a leader in the PC horsepower race, a role it hasn't held since the AT was introduced more than half a decade ago. ■

IBM PS/2 Model 90 XP 486, PS/2 Model 95 XP 486
IBM Corp., 1133 Westchester Ave., White Plains, NY 10604; (800) IBM-2468.
List Price: PS/2 Model 90 XP 486: with 25-MHz 486 microprocessor, 4MB RAM, 80MB SCSI hard disk, 1.44MB floppy disk drive, XGA display subsystem, one parallel and two serial ports, \$12,495; with 160MB SCSI hard disk, \$13,095; with 33-MHz 486 microprocessor, 320MB SCSI hard disk, \$16,695.

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List Price: PS/2 Model 95 XP 486: with 25-MHz 486 microprocessor, 4MB RAM, 160MB SCSI hard disk, 1.44MB floppy disk drive, XGA output, one parallel and one serial port, \$14,145; with 320MB hard disk, \$16,095; with 33-MHz 486 microprocessor, \$17,745.

CIRCLE 715 ON READER SERVICE CARD

A New Breed of Notebook: The Psion 20-Hour MC 600

HANDS ON
by Writ Jones

If being different were all that mattered, the \$2,995 Psion MC 600 would deserve untold accolades. This 80C86-based 8-MHz notebook laptop gets lots of gold stars for its 20-hour battery life but poor marks for overall usability.

The secret behind the battery life is simple: The machine omits display backlighting, uses

lower-power, solid-state storage, and comes with a rigorous set of power conservation capabilities, including a utility that automatically shuts down the processor for short periods of time between operations. The conservation sounds fine on paper, but in reality the MC 600 suffers from technology limitations and poor implementation of some features.

The MC 600 weighs only 5.2 pounds, including the bat-

READY OR NOT, IT'S XGA

by M. David Stone

Arguably the most interesting aspect of IBM's new 486 systems is XGA, or Extended Graphics Array. XGA is two chips (graphics coprocessor and display controller) that offer three mutually exclusive modes of operation: a VGA hardware emulation, an enhanced 132-column VGA text mode, and a native XGA mode.

The XGA resolutions are equivalent to VGA and 8514/A, but go beyond them by offering 256 colors at 1,024-by-768 resolution, and 65,536 (16-bits per pixel) colors at 640-by-480 resolution. According to IBM, the native mode also offers performance improvements of up to 90 percent in DOS, and 50 percent in *Windows* over other PS/2 VGAs.

In extended graphics mode the XGA's capabilities allow it to act as a bus master and utilize system memory for graphics. It can also read from system memory, so for example, it would read raster fonts for screen display. Unlike the 8514/A's I/O mapped drawing control registers, the XGA uses memory mapped registers. These may cause conflicts with memory managers but provide quick register access.

The kicker is that although the XGA's VGA emulation mode is hardware-compatible with VGA registers, the

XGA's native mode is neither VGA nor 8514/A hardware-compatible. The XGA comes with its own adapter interface to remain compatible with programs written to the 8514/A AI (Adapter Interface) in DOS, but that doesn't include many programs.

To offset the lack of hardware compatibility, IBM supplies XGA drivers for *Windows*, Release 2.x and 3.0, for *AutoCAD*, and for *Presentation Manager* in OS/2 1.2 and 1.3. There is no XGA AI driver for OS/2 programs that don't run through PM, but the number of such programs is vanishingly small. The 65,536 color mode at 640 by 480 is currently available only for programs that write directly to the XGA hardware, though IBM says that drivers for this mode are coming.

What does the XGA standard mean in the marketplace? Clearly IBM's intention is for the XGA to eventually supersede both VGA and the 8514/A, but this may be an IBM-centric goal. IBM's implementation of XGA is strictly for the MCA bus. Other manufacturers will no doubt reproduce XGA for ISA and EISA buses. But XGA is currently an interlaced standard at 1,024 by 768, thus subject to flicker. In contrast, you can already buy non-IBM 8514/A-compatible cards with 1,024 by 768 noninterlaced resolution. ■

tery pack. Connectors include a parallel port, mini-din connectors for the provided proprietary serial cable, an optional external CGA monitor cable, and a proprietary port for an external floppy disk drive. A proprietary expansion compartment allows installation of a modem or second serial port.

The machine boots from its 1MB battery-backed RAM disk, which is configured as drive C:\. As long as the system's primary battery pack or backup lithium battery remains

charged, the contents of the RAM disk will be preserved. A second, smaller nonvolatile drive, comprising 256K of Flash memory, holds DOS 3.22, *LapLink III*, and the MC 600 utilities.

For removable storage, the machine accommodates as many as four proprietary solid-state storage cards simultaneously. These optional cards come in three varieties: Flash EEPROM, rewritable RAM disk cards, and read-only mem-

CONTINUES ON PAGE 36

First Looks

Psion MC 600

CONTINUED FROM PAGE 35

ory cards similar to those used in the NEC UltraLite. Psion sells Flash EEPROM in four sizes, from 128K to 1MB; the RAM disk cards use a built-in lithium battery and come in 64K, 128K, and 512K sizes.

As for the read-only memory, if history is any indication, software vendors are unlikely to make applications available on these cards. Each of the slots can accommodate any of the cards, and each appears to the system as a logical drive. To transfer data, *LapLink* and a serial cable are included, or you can purchase either a \$400 external 3.5-inch floppy disk drive for the Psion or an external \$200 solid-state disk drive for your desktop PC.

These solid-state components carry a certain futuristic charm, but they pose problems for the here and now. Today's most capacious arrangement—four 1MB Flash memory cards at \$600 apiece—would leave you with only 5.25 megabytes of nonvolatile, very expensive storage.

Granted, you could get unlimited capacity by keeping a stack of \$600 cards stuffed in your pockets, but the price of this solution is extreme. You would also have a difficult time

**FACT FILE**

Psion MC 600
Psion Inc., 118 Echo Lake Rd., Watertown, CT 06795; (203) 274-7521.
List Price: With 768K RAM, internal 1MB battery-backed RAM disk, battery cartridge, serial cable, DOS 3.22, *LapLink* III, utilities, \$2,995; options available.
In Short: This 8-MHz 80C86-based notebook portable weighs 5.2 pounds including its battery pack and will run for approximately 20 hours on one set of eight AA batteries. The keyboard layout and lack of a backlit display and hard disk render the machine inappropriate for most.

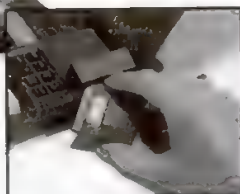
CIRCLE 450 ON READER SERVICE CARD

storing large applications and remembering exactly which little solid-state disk contains which files.

Many users may be glad to avoid the hassles of maintaining nickel cadmium batteries, but replacing eight AA alkaline batteries after every 20 hours of use is an expensive nuisance compared with rechargeable battery packs.

So most buyers will want two options: the \$30 AC adapter, which Psion left out of the standard package, and the nickel cadmium battery pack. The rechargeable pack will run the machine for about 16 hours between charges—still an amaz-

With the exception of the keyboard, the 5.2-pound Psion MC 600 is entirely solid-state. It features Intel's Flash EEPROM memory (see inset). The machine has an 80C86 processor and backlit 620-by-200 CGA display.



ing battery life. Unfortunately, fully recharging the machine requires about 15 hours, whether the machine is on or off.

Compared to other nonbacklit LCD screens, the 620-by-200 CGA display of the MC 600 is surprisingly easy to read, thanks in part to its 9.7-inch diagonal size and to Hitachi's reverse retardation film technology. Even so, you probably won't be happy if you've grown accustomed to backlit screens.

The keyboard's got a nice desktop feel that you won't find on other notebooks, but it has problems, too. To begin with, the Enter and Right Shift keys rest one key to the right of their customary position; the Up Arrow key lies where the Right Shift key should be.

To make matters worse, Psion has placed the function

keys, page control keys, and several other important keys a good way back from the alphanumeric keypad. And instead of being full-sized keys, these ancillary keys are of the small, Chicklet variety.

A final complaint with the keyboard concerns the foggy implementation of several keyboard features. As a particularly annoying example, the on/off key doesn't really turn the machine off but puts it into standby mode. To turn the machine off, you must depress Ctrl-Alt-on/off. We often had to try this combination several times before we could coax the machine into powering down.

And if you leave the machine in standby mode and return about a week later, and you'll find a drained machine with an empty RAM disk. ■

IS FLASH EEPROM READY FOR PRIME TIME?

by Mitt Jones

The Psion MC 600 earns the distinction of being the first laptop to make use of Flash EEPROM technology for non-volatile mass storage.

EEPROM—what we usually mean when we talk about ROM—holds its contents without the need for electricity, but the contents cannot be rewritten without great difficulty. EEPROM is also non-volatile but allows instant rewrites. It is too costly for most PC applications.

Flash EEPROM, pioneered by Intel, lands somewhere in between. It can be erased and rewritten, but not with the speed or ease of EEPROM. Its advantage, and its great promise for PC applications, lies with its low cost and its storage density.

The MC 600 recognizes each Flash memory device as a DOS drive through the use of Microsoft's Flash File System driver, but because Flash devices cannot be partially erased, not all DOS file commands work on them.

If you delete a file from a

Flash device, its name disappears from the directory listing, but the file itself will remain and cannot be overwritten. Gradually, you can end up with a device that appears to have only a few small files but that actually has no free space.

Certain DOS commands, such as CHKDSK, SUBST, and RECOVER, won't work with Flash devices. You'll simply get a message stating that the command cannot be used on network drives, which is how the Flash devices appear to DOS.

Lackluster speed and capacity round out the disadvantages of the currently available Flash devices. In our informal performance tests, the Flash cards appeared to be much slower than hard disks but somewhat faster than floppy disk drives.

As of this printing, Psion's top-capacity Flash card has 1MB, too small to hold even a single copy of *WordPerfect* 5.1. Capacity, however, is one area where Flash devices will certainly improve.

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| ☐ Bongo Black | ☐ Guthrie |
| ☐ Buckingham | ☐ Harem |
| ☐ Circus | ☐ Manuscript |
| ☐ Classic Typewriter | ☐ New York Deco |
| ☐ Copperfield | ☐ Nuts |
| ☐ <i>Coronation Script</i> | ☐ PENWIN |
| ☐ Dateline | ☒ Rockland |
| ☐ Dateline Condensed | ☐ University Ornate |
| ☐ <i>Diner Script</i> | ☐ <i>Waldorf Script</i> |
| ☐ Don Casual | ☒ Zingbats ☐     |
| ☒ <i>Exchequer Script</i> | |

Glyphix fonts work with WordPerfect 5.0/5.1, unlike any other fonts on the market. They're simple to install and simple to use and right now we're running a special, so there couldn't be a better time to try Glyphix.

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CIRCLE 299 ON READER SERVICE CARD

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First Looks

Microsoft Word 5.5: A New Interface, but No New Functions

HANDS ON
by Edward Mendelson

Can a new version of a well-known program be the same as the old, yet also completely different? That's one question raised by Version 5.5 of *Microsoft Word*. The latest release of Microsoft's \$450 character-based word processor offers exactly the same functions as Version 5.0, and creates identical files, but sports a sleek new interface that *Word* veterans will scarcely recognize.

DOS-based *Word* now looks and feels like *Word for Windows*. The old menus that you accessed by pressing Esc are gone, replaced by a set of CUA-compliant Alt-key menus. Instead of pressing Esc-Transfer-Load to open a file, you now press Alt-File-Open. DOS *Word*'s function keys now correspond to those in *Word for Windows*, and F1 brings up a detailed hypertext help system.

Word's treatment of text windows is vastly improved. Windows can now overlap instead of being tiled, and you can finally open a window for editing a stylesheet on the same screen with your text.

Word now has a version of the "ribbon" feature found in

Word for Windows. This offers drop-down menus for styles, fonts, and point sizes, plus hot-spots that let you choose basic formatting with a mouse-click. Oddly, the ribbon's drop-down menu isn't wide enough to show full style names.

The new keyboard interface lets you access all options with Alt-letter keys, rather than navigating with the Tab key. *Word* veterans, however, may resent the need to retrain their fingers and rewrite almost all of their macros. A supplied conversion utility can rewrite only the simplest macros. Styles are now applied with Ctrl-Shift keys rather than Alt keys. Del now deletes permanently and Shift-Del deletes to the scrap, rather than the reverse, and Ins toggles over-type mode rather than inserting from the scrap.

If you prefer *Word 5.0*'s familiar function keys, you can use almost all of them in Version 5.5. You can revert to the old meanings of Del and Ins, but you can't bring back the old Esc-letter menu unless you install the full copy of *Word 5.0* that also comes in the box, presumably to forestall complaints from loyal users. TSRs that modify the mouse don't work with 5.5 as they did with 5.0.

One major loss in 5.5 is the end of the restful nonblinking block "selection," replaced by an ordinary blinking underline cursor. (You can turn off the blink in graphics mode only.)

When *WordPerfect* upgraded from 4.2 to 5.0, functionality increased while the interface stayed the same. *Word*'s upgrade improves its interface while leaving its functions unchanged. Page preview, for example, still can't provide a detailed view. Newcomers and occasional users will welcome

Word's new consistency with standard interfaces, but many expert users may feel that *Word* has lost its uniqueness and familiarity without gaining improved features.

List Price: Microsoft *Word 5.5*, \$450; upgrade from 5.0, \$50.

Requires: 384K available RAM (512K recommended); two disk drives; DOS 2.0 or later or OS/2 1.0 or later. Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; (800) 426-9400, (206) 882-8080.

CIRCLE 713 ON READER SERVICE CARD

Receive Faxes on Your LaserJet

HANDS ON
by Alfred Pool

I hate my fax machine. As much as I like receiving documents almost instantly from around the world, I can't stand the flimsy thermal paper. There are plain-paper fax alternatives, but they're expensive.

The answer to my dilemma has finally appeared: The Fax-O-Matic from Tall Tree Systems. It's a little black box that sits between your computer and your LaserJet (via parallel connections), and connects to your wall phone jack using a standard RJ-11 phone line. If you already own a standalone fax, you can plug it into the loop and use it to send while the Fax-O-Matic receives. When it receives a fax transmission, the Fax-O-Matic translates it and prints it on your LaserJet II. The results are outstanding.

It comes without a manual, but it is so simple to set up that a large sticker on the bottom of the case explains everything—true plug and play.

The product uses the 150-dpi mode of the LaserJet—fine enough to read 8-point text—which means that the standard 512K printer memory is sufficient. It automatically compresses the image from a legal page so that it fits on letter-size paper. During our tests, two pages that we pasted together and sent were squashed vertically to fit on a single page at the receiving end. It looked funny but was completely legible.

The Fax-O-Matic is trans-

parent when it's not in use. Print jobs are passed through to the printer without losing the fax connection. You can also receive transmissions with the computer and printer turned off; the pages are stored in a 512K buffer in the Fax-O-Matic.

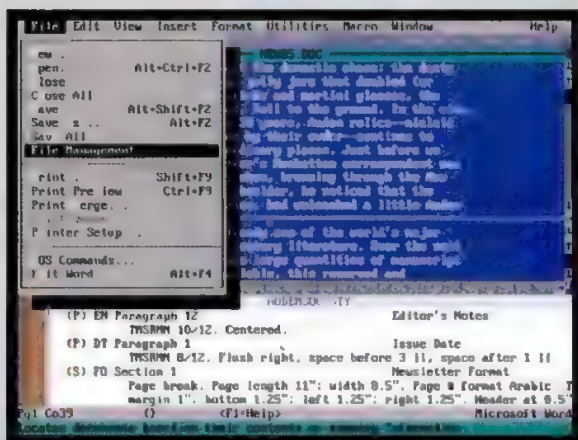
There are a few problems, though. Our tests indicated that the unit was susceptible to phone line noise, producing thin black lines on some pages. This was especially pronounced on a transmission from a fax card; a Tall Tree representative said that they had identified some problems with fax cards that do not implement the G3 fax standards completely. There is also no easy way to disable the unit—the recommended method was to unplug the phone line.

The product lists for \$399, which is about one-half to one-third that of competing products. Add a send-only fax board to your computer for transmissions, and a hand scanner for documents that must be sent as paper originals, and you can have a complete plain-paper fax system for less than a typical thermal-printing standalone fax machine. The Fax-O-Matic may not be perfect, but it is the most cost-effective solution to the problem of flimsy fax paper available today.

List Price: Fax-O-Matic, \$399.

Requires: LaserJet Series II or compatible with at least 512K memory; parallel port; phone line. Tall Tree Systems, 2585 E. Bayshore Rd., Palo Alto, CA 94303; (415) 493-1980.

CIRCLE 430 ON READER SERVICE CARD



Word's new interface follows CUA standards and has overlapping windows.

Product Feature Summary	Lotus 1-2-3 Release 3.1	Microsoft PC Excel®	Borland Quattro Pro®
WYSIWYG Display	Yes	Yes	No
3D Multi-Page Worksheets	Yes	No	No
Text Styles per Sheet	100+	4	8
Mix Text and Graphs on One Page	Yes	No	Yes
Word Wrap Around Graphs	Yes	No	No
Multiple Graphs on One Page	Yes	No	Yes
Print Multiple Worksheets at Once	Yes	No	No
Auto Compress to Print on One Page	Yes	No	No
Worksheet Zoom	Yes	No	No
Color Palette	224	8	16
Automatic Keystroke Recording	Yes	No	No
Relational Database	Yes	No	No
Virtual Memory Management	Yes	386 Only	No
24-Hour, 7 Day-a-Week Support	Yes	No	No

Even our competition is 100% behind us.

Take a look at the chart above and you'll see what we mean. Or listen to actual comments from our customers about the new Lotus® 1-2-3®.

"The product's graphical and WYSIWYG features are great... It gives me professional-quality output with just a few keystrokes... It makes me look good... I wholeheartedly recommend it... It's a slam-dunk!"

They also love its unique way of integrating text and graphics. Its 3D capabilities. Its virtual memory

management system that lets them build larger worksheets more efficiently. Its mouse-support and formatting options. And its compatibility with Windows™ 3.0.

On the other hand, they can't say the same about other spreadsheets. Because the fact is, the new Lotus 1-2-3 is simply superior.

So call us today for a free demo disk. And see why the new Lotus 1-2-3 is already developing quite a following.

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Demo Disk or for
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ext. 541

Introducing Lotus 1-2-3 **3.1**

You won't get fire You may, how

Introducing the NEC PowerMate® SX/20. If you want a system



that will make a noticeable impact on your com-
pany's productivity, it's worth a look, for a
lot of reasons.

The most impor-
tant one being, it's from NEC.

Which means that not only does
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advanced technology, excellent per-

formance and uncompromised quality, it also offers you the security
that your system will be fully supported in the years ahead by people
who will be there when you need them.

Fact is, NEC Corporation is a 24-billion-dollar company. As well as
the world's third largest manufacturer of personal computer systems.



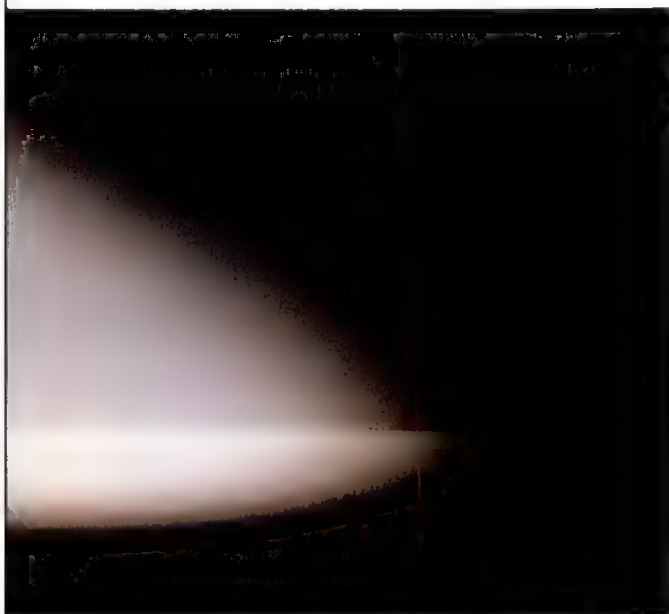
Computers and Communications



d for buying NEC. ever, get noticed.

All of which helps to make a great system an even greater value.

Built around the 20MHz Intel® 386™SX microprocessor operating at
zero wait states, the PowerMate SX/20 offers 2MB of standard



RAM, which is readily expandable
to 16MB. It also gives you the
storage bays and expansion slots
you need to make your system
grow as your needs do.

Best of all, it gives you some-
thing no one else can give you at any price: NEC. A company that
knows the personal computer industry, inside and out.

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The PowerMate SX/20. Choosing it will gain you a certain amount

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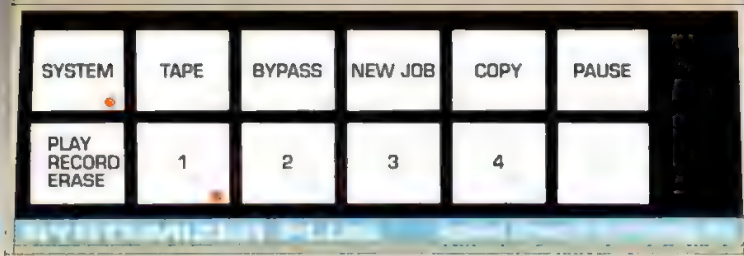
of attention. All of it good.

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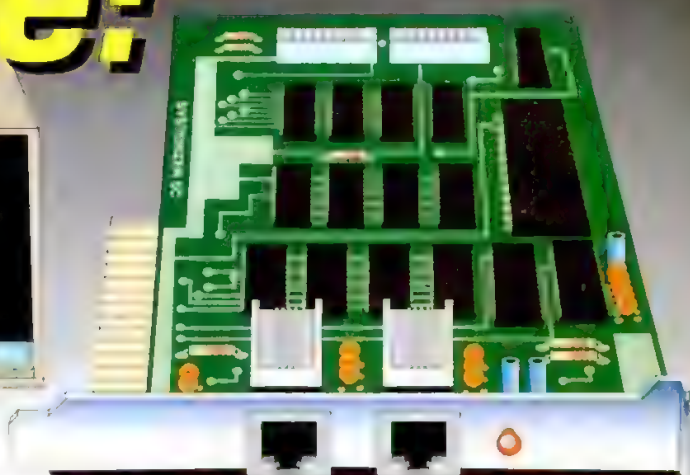
CIRCLE 335 ON READER SERVICE CARD

NEC

SYSTEMIZE and save!



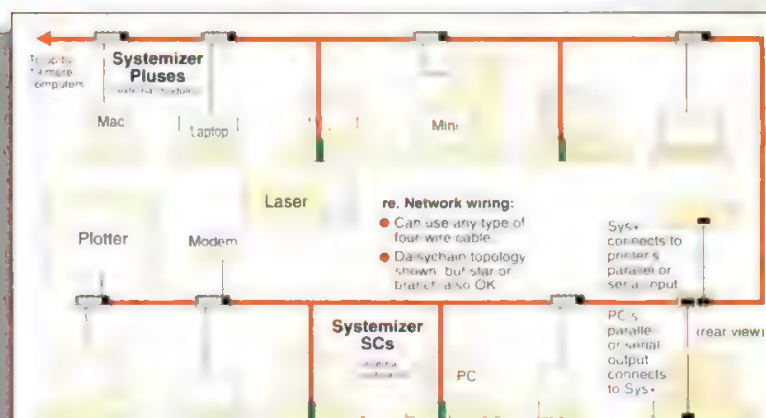
Several models available. The **Systemizer® Plus** shown above is an externally mounted networking module. Because it's self-contained and requires no software in the computer, it can work with practically any computer, operating system and application program.



Or use the internally mounted **Systemizer® SC**, a slot-card version of the Systemizer Plus. For MS-DOS® PC's and compatibles. The SC and Sys+ can be used in the same network, as shown in the diagram below.

Up to 31 users can:

- Share Printers
- Share Plotters
- Share a Modem
- Share a FAX
- Exchange E-MAIL
- Transfer files



Example Systemizer network consisting of 11 micros and a minicomputer, sharing 3 printers and a modem via a mixture of Systemizer Pluses and Systemizer SCs. Note though not shown here, some of the computers could also be connected to a traditional LAN or WAN.

Systemizing is a distributed-processor network-like approach to sharing peripherals, consisting of internally or externally mounted modules. It is a time-tested, proven technology, that has become the connectivity standard at many of the world's largest corporations and throughout the U.S. and Canadian federal governments. Over 50,000 are already in use. Why? Because Systemizing delivers what 95% of corporate computer users want from networking, without the associated costs and complications. In addition, Systemizing fits perfectly into a corporate networking strategy because it will work in conjunction with any LAN or WAN. A company can have the best of both worlds: Systemizing for the ultimate in peripheral sharing, and if needed, a LAN or WAN for users who must access a central database.

Systemizing also offers your company:

- The ability to begin networking NOW, without changing any existing hardware or software. Universal compatibility.
- Freedom to mix computers of all brands in the network.
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First Looks

Crosstalk Communicator: Crosstalk Power Plus Ease-of-Use

HANDS ON
by M. David Stone

The original *Crosstalk 16* has a reputation for being overwhelming; the more recent *Crosstalk Mark IV* combines a powerful script language with an even more overwhelming interface. The \$99 *Crosstalk Communicator (CCM)* offers *Crosstalk Mark IV*'s language masked beneath a new, easy-to-use interface.

Ease of use starts with a slick setup routine that asks a few questions (such as what computer), sets the program to match your answers, then takes you to *CCM*'s startup screen.

The startup screen is a dialing directory, but it can also be used to launch a script. Two of the entries run scripts that guide you through setting up new entries for automatic dialing. One script is customized for PC Board BBSs, and one script for everything else.

In the entry creation script is a menu with choices for nine popular systems, including AT&T Mail, CompuServe, Delphi, Dow Jones News/Retrieval, Lexis/Nexis, MCI Mail, Newsnet, OAG, and VU/TEXT. Just tell *CCM* your user name, password, and in some cases, the local phone number. The program already knows the communications settings for each of these systems, and even comes with a sign-on script and macros for each.

For dialing setups that *CCM* doesn't know about, you have to define your own settings and macro definitions, but both functions are straightforward. You can create a sign-on script using the program's learn mode which records your keystrokes, or create one from scratch with *CCM*'s built-in editor. The built-in CASL (Crosstalk Applications Script Language) is the same as in *Crosstalk Mark*

IV, but the manual covers only those commands typically used in log-on scripts.

CCM offers a full set of file-transfer protocols including CompuServe Quick-B, Kermit, Xmodem, Xmodem-CRC, Xmodem-1K, Ymodem, Ymodem-G, and Zmodem. Curiously missing from this list is DCA's own *Crosstalk* and DART protocols. However, *CCM* can exchange files with other DCA programs, since all of DCA's programs include variations of Xmodem.

Crosstalk Communicator will be appreciated by those interested in using predefined



The *Crosstalk Communicator* startup screen is also the dialing directory.

scripts and macro keys. However, it's suitable for anyone who needs an easy-to-use program with a full range of features. ■
List Price: *Crosstalk Communicator*, \$99. **Requires:** 512K RAM, minimum storage

one 720K floppy drive, DOS 2.1 or later, hard disk recommended. Digital Communications Associates, 1000 Alderman Dr., Alpharetta, GA 30202-4199; 800-241-4762.

CIRCLE 711 ON READER SERVICE CARD

Voice-It Lets Spreadsheets Speak for Themselves

HANDS ON
by Randol Tigrett

Mac folks have been adding voice annotations to their spreadsheets with products like Farallon's *Voice Recorder*. Now PC users can join the club. *Voice-It*, a \$199 add-in for *Lotus 1-2-3*, lets you attach audio notes to your spreadsheet.

It uses the LANtastic Voice Adapter (LVA) from Artisoft as its hardware platform. The *Voice-It* bundle consists of voice software and LANtastic's Voice adapter, a sound digitizing board. If you already own the LVA, the software alone costs \$99.

The Voice Adapter card digitizes any analog sound signal. The sounds you incorporate can be as diverse as a voice that narrates through the contents of spreadsheet cells, background music that soothes spreadsheet-user nerves, or shrieks that accompany the sight of red ink.

Voice-It works with versions 2.01 and 2.2 of *Lotus 1-2-3* and with both MCA and ISA ver-

sions of the LANtastic Voice Adapter. The *Voice-It* software is installed via *Lotus's* Add-In Manager for *1-2-3*; it uses the LANtastic API for audio input and playback.

Recording and playback can be done through the telephone-style handset provided with the Voice Adapter. You'll have to add a small amplified speaker if you want to share the sound. *Voice-It* also comes with pre-canned sound effects, and it's easy to add sounds from a microphone or tape.

When the hotkey is enabled within *1-2-3*, *Voice-It's* menu pops up over the worksheet. The import function attaches a prerecorded message to specific *1-2-3* cells. When the person reading and listening to the worksheet highlights the cell, the message plays.

A toggle option toggles messages between compressed and noncompressed sound formats. A 30-second voice message takes up approximately 247K of disk storage, but the same message takes up about 124K when

compressed. The compressed sound should have a slightly inferior quality, but the combined ears of the LAN Labs crew couldn't tell the difference.

The company is preparing *Voice-It* products for word processors and for ASCII text files. These products weren't ready for review, but will sell for the same \$99. Since the LANtastic hardware provides voice e-mail capabilities to any network e-mail system able to send binary files, an investment could bring a world of multimedia messages to your workplace.

Voice-It adds another dimension to *1-2-3* worksheets. You'll need a complete *Voice-It* system, including the LANtastic Adapter, on every PC that wants to be part of the action. But the price is right, and the number of applications should multiply quickly. ■

List Price: *Voice-It* for spreadsheets, \$99 (software only); software with the LANtastic Voice Adapter, \$199. **Requires:** DOS 2.0 or later and *Lotus 1-2-3*, Version 2.01 or later. *Voice-It* Inc., 1001 Snowden Farm Rd., Collierville, TN 38017; (901) 853-4456.

CIRCLE 712 ON READER SERVICE CARD

First Looks

The Comfort of a Pen, the Movement of a Mouse

HANDS ON
by Bill Machrone

Mice are too big to travel well, and they need a large desktop to be used effectively. Trackballs need to be fairly large in order to have the proper feel; even then they are unsuitable for drawing applications. Proprietary devices such as Isopoint are not adaptable to older machines. Welcome The MousePen.

Appoint's MousePen is the size of an egomaniac's fountain pen and looks like a miniature hockey stick. With neither ego

nor violence, however, it does a creditable job of moving your cursor. Geared to the problems of the road, the MousePen Portable differs from its deskbound sibling only in the length of the cord but offers considerable savings in bulk and tangle. Both units come with drivers, a mouse menu generator, and *Telepaint*, a paint program.

The MousePen looks, feels, and moves like a pen, but you slide it on a flat surface, as you would a mouse. It takes more time to move than a mouse or trackball because you have to



pick it up in your hand. But The MousePen can be used for both clicking and dragging, which it does as well as any mouse and better than trackballs.

The MousePen has ballistic acceleration built right into the hardware, so you'll probably get work done faster, and in less space. While most mice produce a constant number of clicks per inch, the MousePen produces them at a lower rate when moved slowly and a faster

rate when moved quickly.

As a result, you tend to use the MousePen a little differently. You don't have to move the pen continually; a few quick flicks get you across the screen or up to the menu bar. A slow motion takes you right to your target.

Even with the acceleration, the MousePen works fine with the standard Microsoft Mouse driver. Drawing and painting are natural motions. The "left" and "right" buttons are located on the MousePen's shank.

Mice typically have rubber-coated steel balls. Trackballs use a large, weighty roller. The MousePen doesn't have same inertia. Its ball is an unweighted plastic sphere, barely 0.4 inch in diameter. The low mass combined with the on-board ballistics lets you double-click without any jitter.

I found the click effort to be a bit higher than I'd like. The movement lacks the silkiness of the definitive Microsoft Mouse click. And keep a Post-it handy to use as a mouse pad since the MousePen doesn't work reliably on smooth surfaces. It does work fine on cloth or paper.

The hardware that handles the ballistic acceleration is located in the shank of the pen, adding to its thickness. Perhaps a future generation will use flexible circuit boards for a slimmer shape. I'd also like to see the same technology in a tabletop mouse the size of an artist's gum eraser. That way I wouldn't have to pick it up, but I'd still have the other, considerable benefits of this design.

List Price: MousePen and MousePen Portable, \$149.

Requires: 256K, PS/2 input port or serial port, DOS 2.0 or later. Appoint Inc., 1332 Vendel Circle, Paso Robles, CA 93446; (800) 448-1184, (805) 239-8976.

CIRCLE 431 ON READER SERVICE CARD

Meca's PIM Organizes Managers

HANDS ON
by Barry Simon

TMO—short for *The Manager's Organizer*—focuses on a particular class of PIM users: managers. The \$249 package from Meca Software takes the basic Rolodex, calculator, and calendar functions of more-conventional PIMs and adds management features.

In addition to a very simple four-function calculator, there are ten additional fill-in modules including Inflater/Deflator, Days Between Dates, and Loan Amortization.

You can list your service contracts along with their costs and phone numbers, and then dial any service number from the list. The program also keeps a list of your employees with salary information, and will track current and past performance reviews, holidays, vacation days, and job descriptions.

The calendar module has two kinds of to-do lists: reminders and follow-ups. It tracks appointments and phone calls, but there's no alarm function. This makes the need for a resident mode less critical, but *TMO* can be made resident; this requires 21K of RAM.

The Phone Call module lets

you keep a list of calls that need to be made, and then you can mark each call as either completed, message left, or callback promised. This module can be used to track contacts fairly effectively.

Other features include expense reports, trip logs, and various lists. The modules are well integrated, but not perfectly: you can consult a calendar when filling in dates, but usually there is no way to enter the highlighted day from the calendar.

TMO has a spiffy text mode

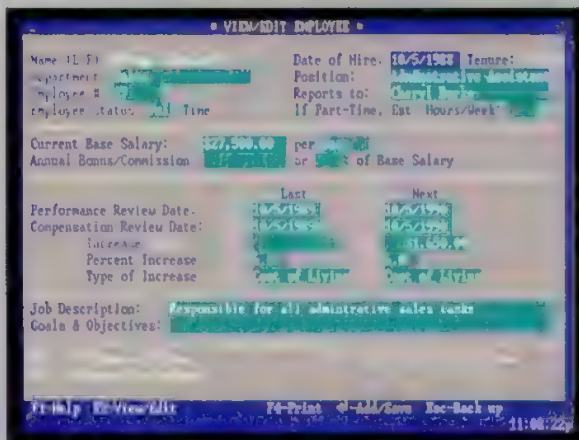
interface with drop-down menus. But the dialog boxes are not standardized with some of the existing function-key-driven choices, and the program lacks mouse support.

All things considered, though, *TMO* is well made and inventive. Any manager who is searching for a PIM should put *TMO* on the shopping list.

List Price: *The Manager's Organizer (TMO)*, \$249.95.

Requires: 512K RAM, DOS 2.0 or later. Meca Software, 327 Riverside Ave., Westport, CT 06880; (203) 226-2400.

CIRCLE 432 ON READER SERVICE CARD



TMO lets managers view and edit an employee's status, salary, as well as keep a log of performance records.

DOS Lives. Despite what you may have read.



Insufficient memory to run application;

close one or more applications to increase available memory and try again.

Windows 3.0 may have been a big step forward for some programs. *When Windows 3.0 says there's not enough room to run your DOS programs, it's just trying to tell you it needs QEMM 5.1.*

But it was a big step backward for DOS. Suddenly, it was 1987 all over again. Not enough room for DOS programs to run because TSRs, utilities, drivers and buffers were taking up room your DOS programs need.

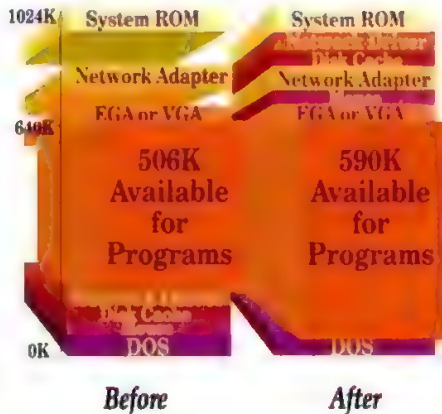
QEMM 5.1 to the rescue

Now, we've updated QEMM to provide additional memory for DOS programs within Windows 3.0.

QEMM 5.1 works with the built-in capabilities of your 80386 or i486 processor to find and recover unused memory segments. As you can see in the chart, there are gaps in your PC's memory usage above 640K. QEMM 5.1 fills those gaps and provides more room for your DOS programs to run.

And of course, QEMM 5.1 still works with DOS when you're not running

Windows. You get all the same benefits: up to 130K more memory to run the new generation of memory-hungry programs; space for larger spreadsheets and database files.



Unused memory is like hidden gold in your PC. QEMM finds it and makes it available.

Introducing DESQview 2.3 and DESQview 386 2.3 for users of Windows 3.0

They said it couldn't be done, but DESQview 2.3 can run Windows 3.0 programs. Not just in Windows "Real mode" but in "Standard" mode. That means programs can be up to 16MB.

And it can run DOS programs and DOS-extended programs i.e., 1-2-3 Release 3, side-by-side.

DESQview 386 2.3 does all that and more. It lets you run 386 DOS extended programs like AutoCAD 386 and IBM Interleaf side-by-side.

DOS, extended DOS; Windows—whatever standards you set, we will support. We're committed to helping you get the most out of your hardware and software today. And tomorrow.

QEMM-386 System Requirements: 80386-based PCs and PS/2s and PCs with 80386 add-in boards. Operating system: PC DOS 2.0-4.0, MS-DOS 2.0-4.0, Windows 3.0. Conventional memory requirement: 1.5K.

DESQview System Requirements: IBM Personal Computer and 100% compatibles (with 8086, 8088, 80286, 80386 or i486 processors) with monochrome or color display; IBM Personal System/2 • Memory: 640K recommended, for DESQview itself 0-150K • Expanded Memory (Optional): expanded memory boards compatible with the Intel AboveBoard; enhanced expanded memory boards compatible with the AST RAMpage; EMS 4.0 expanded memory boards • Disk: two diskette drives or one diskette drive and a hard disk • Graphics Card (Optional): Hercules, IBM Color/Graphics (CGA), IBM Enhanced Graphics (EGA), IBM PS/2 Advanced Graphics (VGA) • Mouse (Optional): Mouse Systems, Microsoft and compatibles • Modern for Auto-Dialer (Optional): Hayes or compatible • Operating System: PC-DOS 2.0-4.0; MS-DOS 2.0-4.0 • Software: Most PC-DOS and MS-DOS programs; programs specific to Microsoft Windows 1.03-3.0, GEM 1.1-3.0, IBM TopView 1.1 • Media: DESQview is available on either 5 1/4" or 3 1/2" floppy diskette.

Trademarks: Windows, MS-DOS: Microsoft Corporation; PS/2, Interleaf, TopView: IBM Corporation; 80386, i486, AboveBoard: Intel Corporation; 1-2-3: Lotus Development Corporation; AutoCAD 386: Autodesk, Inc.; RAMpage: AST Research; Hercules: Mouse Systems; Hayes: GEM, Digital Research, Inc.

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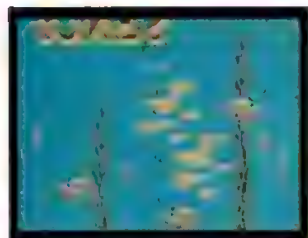
Quarterdeck Office Systems, 150 Pico Blvd., Santa Monica, CA 90405 (213) 392-9851 Fax: (213) 399-3802

First Looks

DeluxePaint Animation Sets Your Screen in Motion

HANDS ON
by Robert Kendall

Electronic Arts brings the animator's studio to the PC with *DeluxePaint (DP) Animation*. Though this \$134.95 package won't produce *Fantasia*, it can

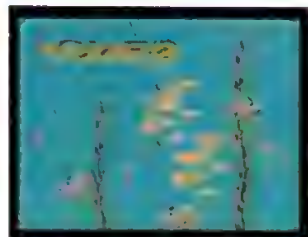


add action to business presentations, whip up demos, or help satisfy your creative urges.

The program emulates its ink-and-cellophane counterpart by letting you craft individual frames (screens) and play them back as a sequence. Unlike the laborious traditional method, *DP Animation* lets you easily move an image over a specified number of frames. All you have to do is pop up a dialog box and type in the distance you want to move the object and the number

of frames over which the move should occur. The program calculates the rest.

You can rotate the image on any axis in three dimensions while it's being moved, and change the speed of movement during the sequence. Many images can move simultaneously, though animating each one is a



separate procedure.

The program has easy-to-use special features. You can cut out any screen image and wield it as a brush, stamping it anywhere in the current frame or on successive frames by clicking a mouse button. You can also cut out a sequence of changing images across a series of frames and copy or save the sequence.

A particularly nice feature lets you take two images and

generate a sequence in which the first metamorphoses into the second. This isn't true tweening, which would let you, for example, take two images of a man with his arm in different positions and generate intervening frames. *DP Animation's* metamorphosis feature blends the first image into the second.

The paint tools for fashioning your masterpiece include nearly everything found in the program's ancestor, *DeluxePaint II Enhanced*. There are tools for fashioning complex symmetrical patterns and for overlaying semitransparent images. A perspective tool creates backgrounds by tiling an image



DeluxePaint Animation lets you move any image while rotating it in 3 dimensions.

on a plane that you can rotate in three dimensions. There's a selection of over 20 fonts, although the range of sizes is limited. Stretching or shrinking text can quickly render it illegi-

ble. An additional seven multi-colored fonts are available for \$69.95. Since the package lacks support for video modes other than the very low 320-by-200 resolution in 256 colors, it's limited to systems with a VGA or MCGA display.

The vendor provides some clip art with the program, including animated sequences, and you can place .PCX files directly in a frame. A conversion utility converts files to and from TIFF, Windows Paint, and MacPaint formats and translates high-resolution files into the 320-by-200 resolution. Unfortunately, much of the detail disappears after conversion.

There's also a screen capture utility, and a playback utility that lets you string together and loop separate animations. Key-strokes allow pauses and backward or forward movement, but you can't jump or create branching menus. A runtime version allows you to distribute your animations freely to other users.

List Price: *DeluxePaint Animation*, Version 1.0, \$134.95. **Requires:** 640K RAM, 5MB hard disk space, mouse, VGA or MCGA display, DOS 2.11 or later; EMS recommended. Electronic Arts, P.O. Box 7530, San Mateo, CA 94403-7578; (800) 245-4525.

CIRCLE 434 ON READER SERVICE CARD

InnerSource: Looks like a Power Supply, but It's Really a UPS

HANDS ON
by Edward Mendelson

PC Power & Cooling's \$495 InnerSource is the invisible UPS. Most uninterruptible power supplies are bulky real-estate-hogging standalone units. The InnerSource occupies otherwise unusable space in your computer's power supply.

Except for its sleek black finish, the InnerSource looks exactly like any power supply. Its 14-pound heft is the only clue that it contains both a standard power supply and a battery that can keep your computer running for almost 20 minutes after a blackout, brownout, or power surge.

You install the InnerSource the same way you install any power supply. Loosen four screws to detach the existing supply, unplug four or five keyed cable connectors, remove the old power supply, and replace it with the InnerSource. It takes less than 15 minutes.

When your power fails, the InnerSource sounds an alarm. If you're nearby you have time to save your files and close your applications before the unit turns off the power cleanly when the battery drains.

PC Power & Cooling claims that the battery provides 5 to 10 minutes of power. On my heavily loaded system with two hard disks and 8MB of RAM, it last-

ed 18 minutes. The 12-volt lead-acid battery needs no maintenance, and recharges itself in 4 to 8 hours. Recharging takes place whenever the computer is plugged into a live power source. Battery life is rated at three to five years.

You can buy the UL-approved InnerSource in three different models: one for standard AT-style desktop machines, another for towers, a third for XT-size computers. You can order at no charge an optional "SQ" configuration with slightly lower power but a quieter fan.

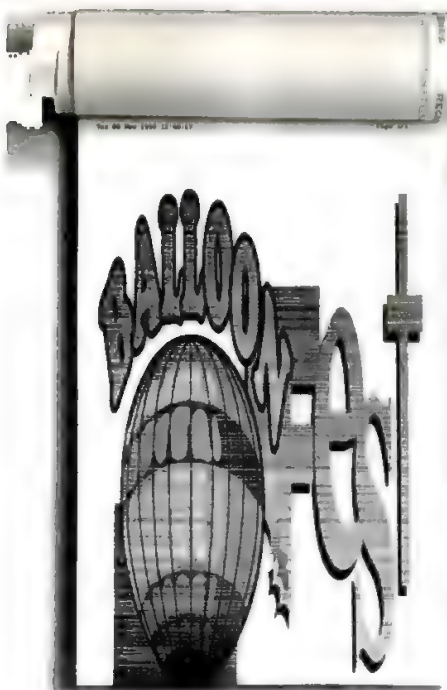
A supplied adapter cable lets you plug your monitor into the switched outlet on the back of the unit—an outlet present on all power supplies, but normally left unused unless you use a low-wattage monochrome mon-

itor. The InnerSource supplies 220 watts of DC output to the computer and 100 watts of AC output to the monitor, which is the same as you get from a 550VA external UPS. But an external UPS can also supply power to your printer.

You'll forget that it's there until you need it. If you value your data but don't want extra wires and boxes, the InnerSource is the UPS you need.

List Price: InnerSource, \$495 (specify desktop, tower, or XT size when ordering); NetWare interface, \$49. **Requires:** Any computer that uses a standard-dimension desktop or tower-case power supply. PC Power & Cooling, 31510 Mountain Way, Bonsall, CA 92003; (800) 722-6555, (619) 723-9513.

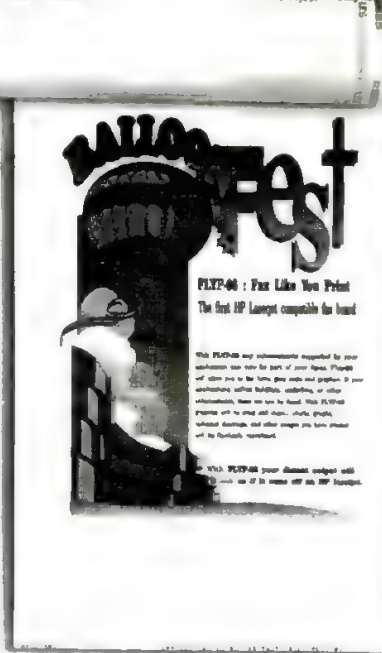
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First Looks

allClear Lets You Diagram Your Thoughts

HANDS ON
by Henry Fersko-Wass

In this age of visualization where software is becoming more and more graphic, we now have a program that can turn our thoughts into pictures. Stated in less lofty terms, the \$299.95 *allClear* from Clear Software takes text input and turns it into simple flowchart diagrams that use the typical box, diamond, and ellipse symbols along with connecting arrows and yes/no statements.

allClear is ideal for getting a visual grip on corporate policy or organizational structure, presenting procedures for filling in complex forms, providing technical support, or offering instructions on how to get through almost any procedure-based activity. As you construct and diagram your events, *allClear*'s flowcharts reveal the underlying logic—or lack of logic—in your thoughts.

allClear's diagramming functions are not based on drawing or paint tools. You begin the diagrammatic process by creating a text file using *allClear*'s internal text editor or by linking automatically to your favorite

word processor. The program accepts the native file format from most word processors or will work with ASCII import.

Text files are composed using plain English, but embedded punctuation marks and parentheses are subsequently added according to *allClear*'s language rules. These syntactical additions generate the program's dozen or so diagram elements. For example, an embedded ? initiates a yes/no branching path in your text; or, a sentence with a period at the end automatically becomes a box. In this manner you can include elements such as branching, a straight statement, yes/no statements, GOTOs, WHILEs, IFs, or loops.

Learning *allClear*'s language takes a little time; in essence it's a programming language for nonprogrammers. But because you can link directly to your word processor, it's easy to experiment with the embedded commands and jump back and forth from a text file to the diagram to see how things look. The program responds with understandable error messages when you make a mistake in syntax.

**FACT FILE**

allClear, Version 1.1
Clear Software Inc., P.O. Box
909, Brookline, MA 02146;
(617) 232-4720.
List Price: \$299.95.
Requires: 512K RAM (640K
RAM recommended), DOS 3.0
or later.
In Short: *allClear* produces
flowchart diagrams from your
text input.

CIRCLE 718 ON READER SERVICE CARD

Creating the diagram from a properly written text file is actually quite simple. A single style-sheet controls all of the diagram options. You can choose from various diagram types: procedure, tree, or decision-tree, and then add fonts, shape assignments, margins, and page layout. In a single 15-minute session you can design and produce flowcharts. Modifications and enhancements take a matter of seconds. The character-based diagrams appear on-screen in clean, crisp layouts with shadows on the diagram shapes if you want it.

One of the more intriguing features in *allClear* is the ability to produce diagrams directly from *Lotus 1-2-3* or *Symphony* spreadsheet input. The scripts that contain the syntax for these diagrams can be built within the spreadsheet using active table data, such as a list of a compa-

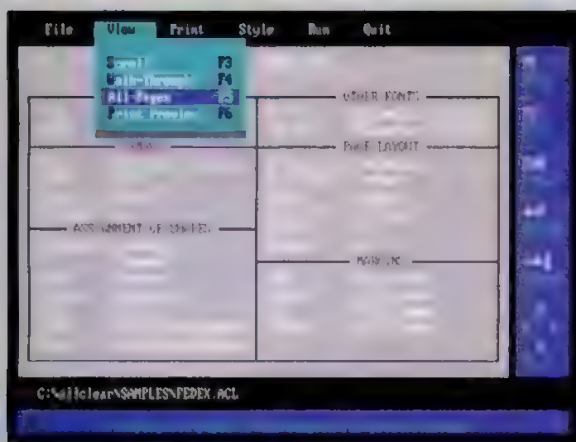
ny's employees, their positions and salaries. When this information is updated *allClear* reflects the change.

Diagrams can be viewed on-screen from several different perspectives. You are enabled to scroll as if the diagram were laid out in full across a room wall, you can "walk-through," moving from symbol to symbol in logical order, you can look at the entire layout page by page, or you can have a WYSIWYG display. The walk-through view mode is very suitable for both checking your logic and using the diagram to work through a procedure.

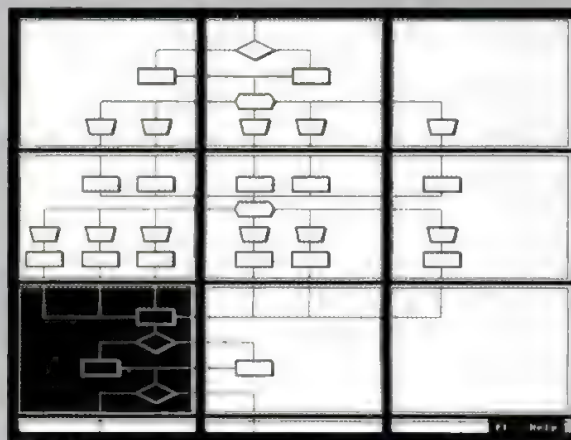
For printouts, you can force the whole diagram to a single page or let it print across pages—in a portrait or landscape orientation. Printing can be a background process and most major printers including LaserJet- and PostScript-compatible ones are supported.

If you've ever sat down with a pen or pencil to diagram your thoughts, you'll appreciate the computerization of this important part of the thinking process. Though it doesn't rely on any super-snazzy graphics, *allClear* provides a tool to help you visualize the logic behind complex ideas.

Outline processors are great tools for one-dimensional linear thinking. But if your ideas tend to branch off in different directions, you should consider *allClear*. ■



allClear's menu lets you control the fonts and shape the assignments, margins, and layouts of its flowchart.



allClear flowcharts are created automatically from text in a word processing document.

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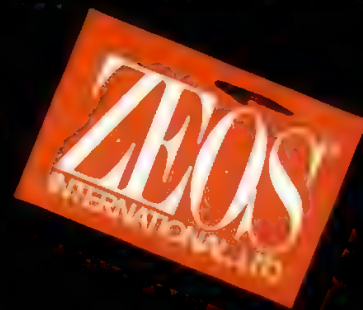
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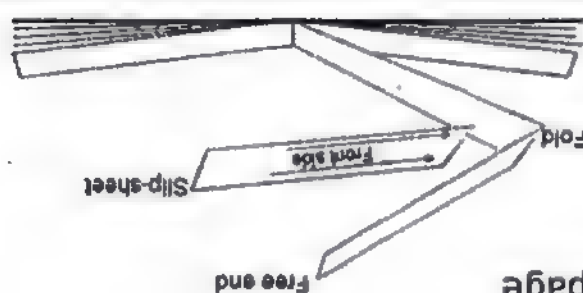
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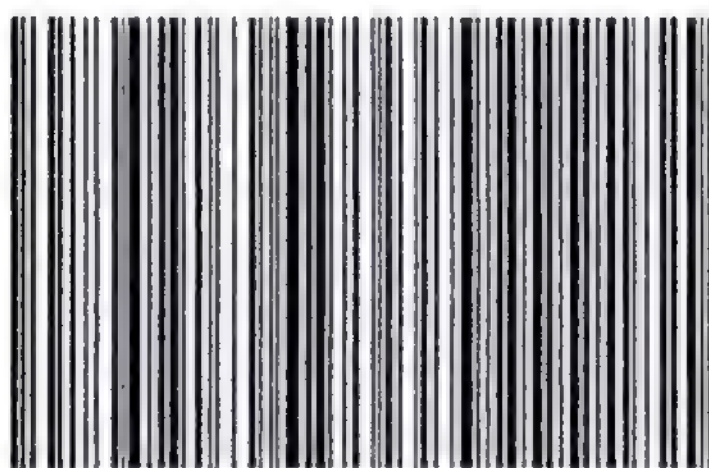
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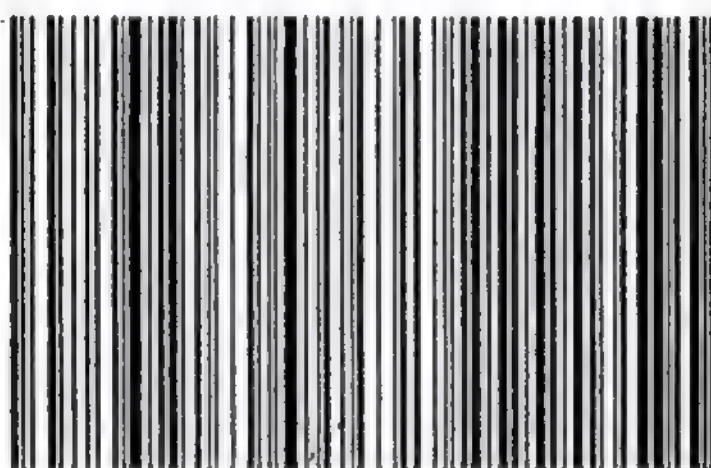
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Reason #2

Dazzling Performance.

In one recent '386 review, *PC Magazine* awarded ZEOS Editor's Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

Dazzling Performance is built into every ZEOS system. It's a key component of ZEOS Overall Excellence.

Reason #3

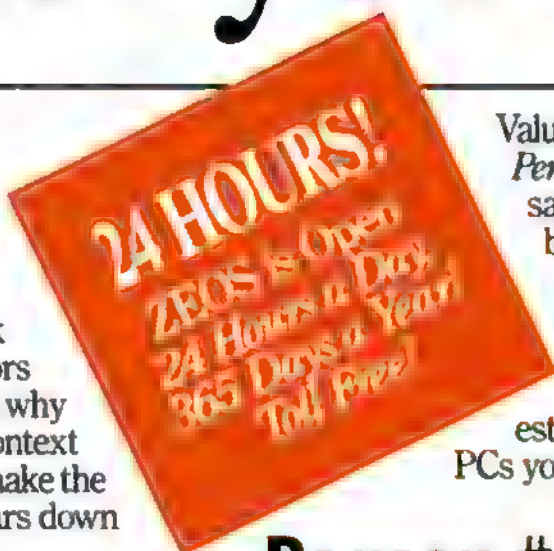
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Reason #4

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Value: Excellent"

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In magazine after magazine and review after review ZEOS systems are cited for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

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First Looks

ScanMan 256 and Ansel Improve The Art of Hand Scanning

HANDS ON
by Barry Simon

Logitech's ScanMan and ScanMan Plus defined the hand scanner market for a time, but hardware support limited to 200 dots per inch and 1-bit black-and-white images rendered these scanners obsolete. Logitech's new \$499 ScanMan 256 reestablishes the ScanMan family as the standard for hand scanners. And the complementing software, *Ansel*, makes image manipulation easier than ever.

The ScanMan 256 package includes a scanner, a half-slot adapter card, software drivers, a DOS-level quick-scan utility, and *Ansel*—a Windows 3.0-based program that controls the scan and is a gray-scale paint program. *Ansel* is also available to registered owners of ScanMan Plus for \$29. The ScanMan is available in both ISA and MCA architectures.

The scanner is state-of-the-art, with full 8-bit 400-dpi hardware. Buttons on the scanner let you set the number of bits (1-bit black and white, or 16, 64, or 256 gray scale) and the resolution (100, 200, 300, or 400 dpi). When set to black-and-white

mode, the scanner emulates the older ScanMan Plus, so it works with software that supports that standard.

A scanning speed indicator lets you know how fast you're scanning and offers the feedback you need to keep the scan speed even. As long as I didn't move the scanner too quickly, it could adjust for uneven scanning speed perfectly.

It was so accurate that I was able to scan an image that was over 4 inches wide in two passes, and then seamlessly stitch the two together using *Ansel*. The well-written documentation offers simple guidelines for achieving the optimal scan.

The adapter will work in either 8- or 16-bit slots. When it's in a 16-bit slot, you can set the IRQ used by the scanner to one less likely to cause conflicts. The driver, which must be installed to use the scanner, takes about 8K of memory and works fine when loaded into high memory with *QEMM*.

The DOS-level scan utility, run from the command line, is meant to accommodate non-Windows users or quick scans. It lets you save in one of four formats (.PCX, .IMG, TIFF, and TIFF

The ScanMan 256 can scan at resolutions from 100 to 400 dots per inch, using 256 shades of gray.

compressed) by entering the filename, size of the file, and format. After scanning, you get an on-screen preview, after which you can save, abort, or ask the program to rescan.

The star of the package is the Windows-based *Ansel*. Used with a 16-color VGA driver, it offers 12 gray shades dithered to emulate the full 256 shades of gray. With 256 color drivers, it uses 64 colors (shades of gray). Sixty-four colors is the maximum number supported by the VGA hardware.

Ansel will read or write files in TIFF, .BMP, and .PCX, and allows you to manipulate the ScanMan 256 directly. As a paint program it offers three types of tools: fixed transformations, variable transformations, and paint tools.

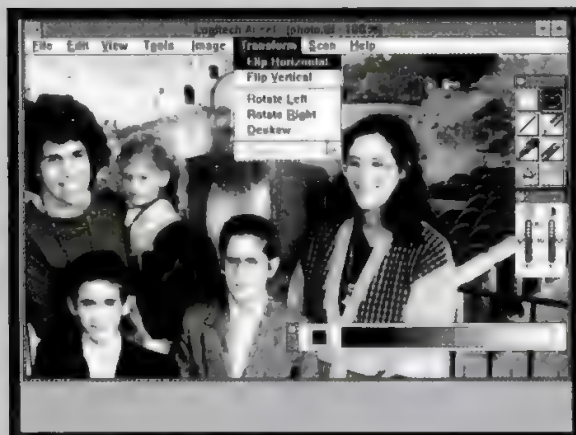
Fixed transformations include rotation in multiples of 90 degrees, global lightening and darkening of an image by 20 shades of gray at a time, smoothing, sharpening, negating (inverting a gray-scale order), and equalizing. The Equalize tool spreads the palette to incorporate a larger spread of grays.

Variable transformations include global adjustments of brightness, contrast, and scale. The most unusual of these is a transformation called "deskewing"—a mathematical rotation by a variable angle. As the name implies, the transform is intended to compensate for a scan that wasn't straight. The combination of deskewing and stitching tools considerably expands the capability of the hardware.

Paint tools allow pixel editing with a pencil (single-pixel mode) or brush and line drawing. The color (shade of gray) can be picked from the screen with an eyedropper or from a palette. This is the program's weakest area: There's no pour tool, no individual color manipulation, and no square or circle drawing.

Ansel has other weaknesses. The print samples came out darker than they appear on screen. The lack of paint tools can be problematic. The color photos I scanned in appeared washed out, but that's to be expected. The Equalize filter improved the photos, but the lightest colors mapped to stark white. I had to hand-color at the pixel level to turn the whites to light shades of gray.

Nonetheless, if you are in the market for a gray-scale hand scanner, Logitech's ScanMan 256 should be very high on your shopping list.



The ScanMan is packaged with *Ansel*, a grayscale editor whose graphical interface includes a visual toolbox. The deskewing option adjusts for any misalignment caused by shaky hand motions.



FACT FILE

ScanMan 256

Logitech, 6505 Kaiser Dr.,
Fremont, CA 94555; (415) 795-8500.

List Price: \$499; Micro Channel version, \$599

Requires: Microsoft Windows 3.0 for use with *Ansel*; mouse.

In Short: A state-of-the-art, 400-dpi, 8-bit hand scanner and *Ansel*—a lovely gray-scale paint program—team up to keep ScanMan the standard for hand scanners.

CIRCLE 436 ON READER SERVICE CARD

First Looks

CASE:W Slashes Windows Development Time with Prototyping and Code Generation

HANDS ON
by Richard Hale Shaw

The *Windows* 3.0 GUI brings elegance and simplicity to user interfaces, but it's a potential minefield for developers.

Often, building a simple program means knowing how to create and write several different types of files—not to mention how to write the code that makes it work. *CASE:W* 3.0 (*Computer Aided Software Engineering for Windows*) from CASEworks prototypes the application and generates the code required to create the windows, menus, and dialog boxes.

More specifically, *CASE:W* generates the window procedures for basic routines, as well as for the header file, resource script, make file, and module definition file. And with the new-to-this-version Test View feature, you can try out the application before you compile it.

That's not to say that the \$495 package writes your application for you. Rather, it eliminates the labor-intensive parts of creating a *Windows* application by providing a detailed skeleton of the program code, leaving you to fill in the code specific to your particular application.

Typically, even simple tasks such as adding an icon to an application involves several steps. First you create the icon, then put a reference to it into the resource script (.RC), then add a line to the program's C or C++ source code, then compile the source and the resource script.

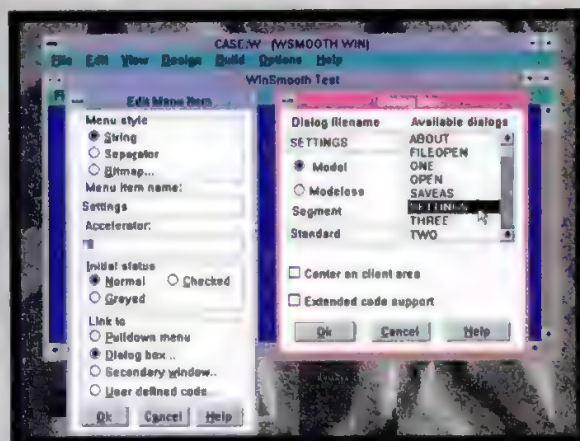
With *CASE:W*, you still have to use an icon editor to create the icon, but the construction is simplified. You just click on the icon filename with the mouse and the icon is automatically included in the program.

CASE:W fills in the details

of each window (color, visibility attribute, size, title bar, system icon, action bar, menu entries, and so on), and also adds the code for handling scroll bar logic—all with a few mouse clicks. Thus, its greatest strength is in eliminating the monotonous, time-consuming parts of creating a *Windows* application.

CASE:W lets you run other *Windows* programming tools directly. Entries for the required *Windows SDK* (*Software Developer's Kit*) tools—the Dialog, Font, and Icon Editor—are included as part of the built-in menu. You can add up to 12 more tools, but there really shouldn't be a limit. Besides, the interface for adding tools could be improved.

Once you create a dialog, *CASE:W* lets you link the dialog to a menu entry, generating the appropriate linkage code. It can also generate code to access unlinked dialogs. You can add data validation and formatting facilities to a dialog box code,



CASE:W does an admirable job of generating the source code for the skeleton of a *Windows* application. You flesh out the application-specific code. The menu shown here lets you specify a number of window parameters and attributes.



FACT FILE

CASE:W, Version 3.0
CASEworks Inc., 1 Dunwoody Park, #130, Atlanta, GA 30338; (800) 635-1577, (404) 399-6236.

List Price: \$495; Corporate Edition, \$995.

Requires: 2MB RAM, 5MB disk space, EGA or VGA monitor, mouse, *Windows* 3.0, Microsoft *Windows SDK*, Microsoft C 5.1 or later.

In Short: A valuable but not essential *Windows* programming tool, with prototyping, code generation, and software management capabilities.

CIRCLE 433 ON READER SERVICE CARD

as well as define the related code variables. There's full support for managing the standard *Windows* controls, including combo boxes.

When you're ready to generate the code, *CASE:W* creates the necessary files in Microsoft C (*CASE:W* requires Microsoft C 5.1 or later). While you can control some of the compilation options such as memory model selection, you'll have to edit the generated make file to use Microsoft C's full optimization facilities.

CASE:W offers three levels of control over the comments in the generated code. If you select the highest level, the commenting is profuse. It places function

prototypes in the header files along with declarations of global variables. And it generates string tables for error messages in the resource script.

The generated source code is plain-vanilla *Windows* code, but you may have some complaints about the way the code is formatted and commented. *CASE:W* uses the traditional C function headers and braces. The comments are the older "/* */" comments for C, and they often contain unnecessary commercials for *CASE:W* capabilities—something that has no place in professional source code. Braces are indented in the traditional manner—aligned to the left under the beginning of a block. It would be better if the program offered the option of using the improved ANSI C facilities. However, the code does use the present-day Hungarian Notation for defining and describing data objects.

Once you've generated the source code and compiled it, you can flesh out the skeleton by adding application-specific code, or make changes to *CASE:W* code with the editor of your choice. You can preserve your code changes after an interface change through regeneration. Thus, if you intermingle your own code with *CASE:W*-generated code, regeneration will retain your changes despite subsequent changes to the interface. Other programs such as Candlelight's *WindowsMaker* keep generated code and application-specific code in separate source files; changes to the generated code are lost with subsequent regenerations.

Since *CASE:W* maintains a .WIN file for each window you define, you can create a database of different window definitions and reuse them in different applications. You can also reuse them with CASEwork's software package developed for the OS/2 Presentation Manager version, *CASE:PM*.

While I don't consider *CASE:W* an essential *Windows* programming tool, every *Windows* development group should have a copy. With the time you'll save creating your *Windows* 3.0 programs, it'll pay for itself shortly. ■

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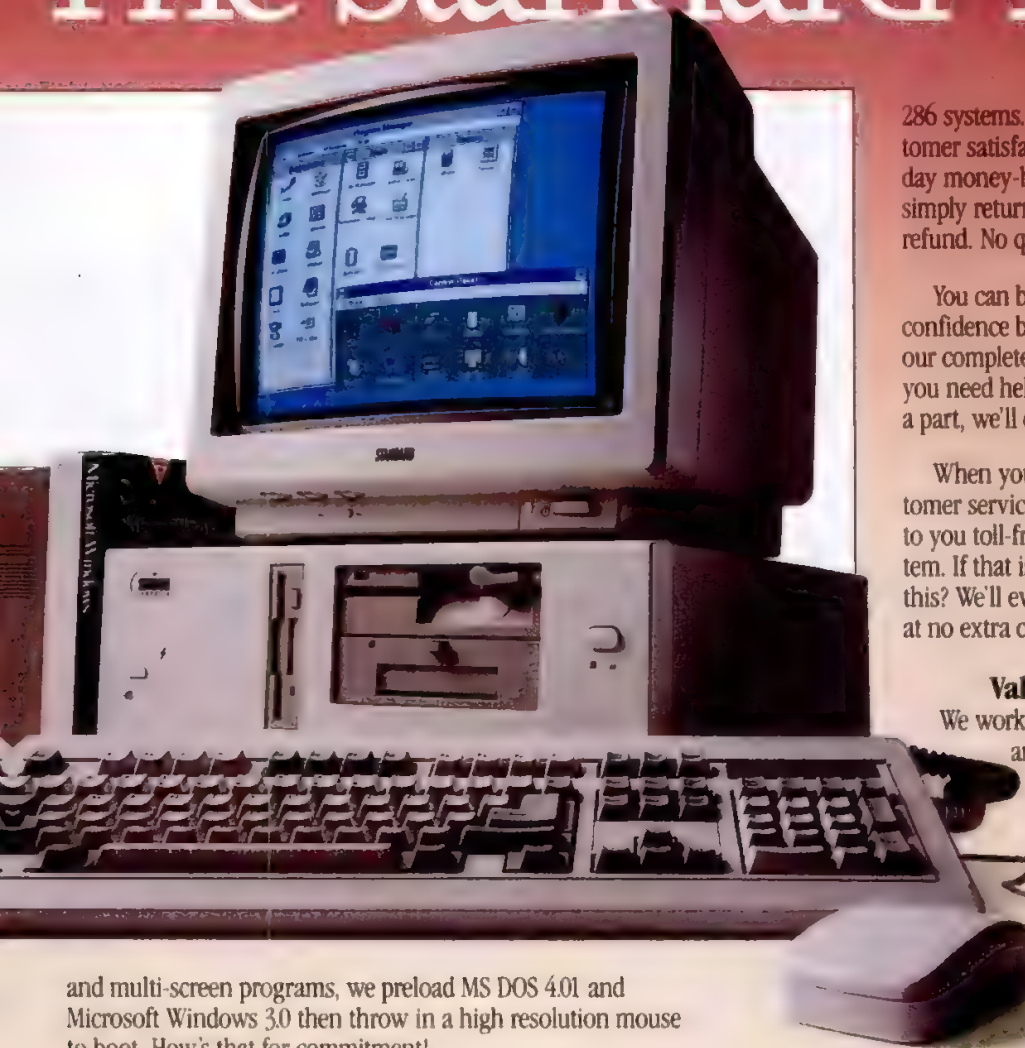
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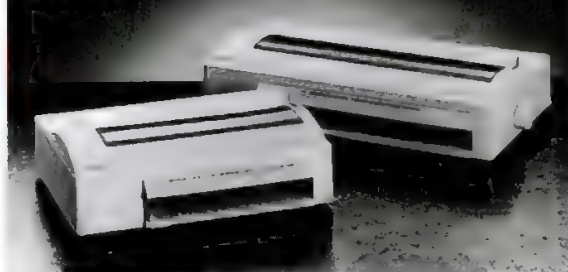
News of Announced Products and Upgrades

Faster, Bigger Bubble Jets

NEW

Canon USA has announced two desktop Bubble Jet printers that promise faster high-quality output and better paper-handling capabilities. At 10 characters per inch (cpi), the BJ-300 and BJ-330 print at 300 characters per second (cps) in high-speed mode, and at 150 cps in high-quality mode. Both machines feature standard fanfold push tractor feed, automatic sheet feed, and manual front loading. The printers' paper-parking feature allows the user to load paper in all three feeders simultaneously, then choose the paper supply as needed. The BJ-300 has a maximum print width of 8 inches for letter-size sheets; the BJ-330 can print as wide as 13.6 inches, and accepts paper sizes up to 11 by 17 inches. As with other Bubble Jets, maximum print resolution is 360 dpi, and the print noise is 45 dBA, significantly less than most dot matrix printers. The new Bubble Jets include a 30K RAM buffer expandable to 128K, and feature three typefaces: Courier, Prestige, and Gothic. Additional font cards are optional. The BJ-300 emulates the IBM Proprinter XL24E and Epson LQ-850, while the BJ-330 emulates the IBM Proprinter XL24E and the Epson LQ-1050.

The new Canon Bubble Jet printers ship with a one-year warranty.



List Price: BJ-300, \$799; BJ-330, \$949.

Canon USA Inc., Printer Division, One Canon Plaza, Lake Success, NY 11042; (516) 488-6700.

CIRCLE 436 ON READER SERVICE CARD

Origami Comes To CAD

NEW

A CAD Group announces two new 3-D software tools for architects. A CAD-Makette helps expand the presentation possibilities of AutoCAD by transforming a sketch design into a paper model. The program will take most 3-D AutoCAD models, unfold them, and add gumslips where appropriate. It then makes a special drawing

file which may be sent to the plotter.

A CAD-Site is an AutoCAD application for use on top of common architecture packages. Its purpose is to make a designer more productive during the initial design phase by providing facilities for manipulating and structuring 3-D build forms and schematic floor plans. Then, while the user edits the design, the software keeps track of all quantities.

List Price: A CAD-Makette, \$275, A CAD-Site, \$895.

Requires: AutoCAD, Release 1.0. A CAD Group Inc., 233 Peachtree St. NE, #404, Atlanta, GA 30303; (404) 523-8544.

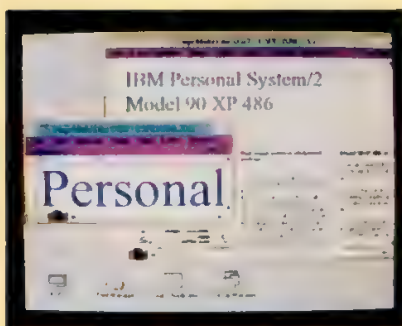
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A CAD-Makette turns CAD drawings into solid models. The user applies the glue.

HOT PROSPECT

IBM INTRODUCES OS/2 1.3 WITH LOWER HARDWARE REQUIREMENTS



OS/2 EE gives users benefits provided by Adobe Type Manager.

simplifies printing over a network. **List Price:** OS/2 Standard Edition, \$340. Contact your local IBM representative, or call (800) 426-2468.

CIRCLE 437 ON READER SERVICE CARD

IBM Corp. announces an enhanced version of Operating System/2 (OS/2), with memory requirements reduced to 2MB to make it more easily accessible to users who want OS/2 without spending even more cash on memory. These benefits will also be implemented throughout the OS/2 Extended Edition and the LAN Server once they become available. Version 1.3 also includes Adobe Type Manager to help users generate consistent high-quality type across a variety of printers and displays. According to IBM, enhanced printer support makes printing faster, and makes printers easier to install.

The interface to the new print spooler sim-

Remote Control Via a Mouse Is Possible

NEW

Users of remote control software have long been slaves to the command line interface. Avalan Technology's *Remotely Possible* now makes it possible for the master PC on a Novell network to remotely control a slave PC with a mouse. *Remotely Possible* works with all types of mice and trackballs including two- and three-button mice, serial, bus, and PS/2 mice. The memory-resident program requires 17K RAM; it also runs in High DOS and supports Windows 3.0 applications in real mode. Avalan believes this product will help corporations preserve investments in existing PCs by allowing any 286 machine to run memory-hungry server-based applications which require 386 machines and a mouse. Users may

CONTINUES ON PAGE 56

New&Improved

assist other users, or watch as other users control the PC; users can even reboot remote machines. For the security conscious, *Remotely Possible* features multiple levels of password and user ID codes to limit access to remote PCs. Pricing for *Remotely Possible* goes on a per-user basis, so there is no penalty when you add additional file servers.

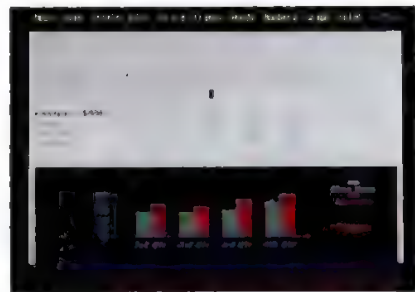
List Price: *Remotely Possible* for two users, \$199; for eight users, \$299. **Requires:** 17K RAM, Novell NetWare 2.0a or later. Avalan Technology, Timothy Fiske House, 747 Washington St., Holliston, MA 01746; (800) 441-2281 or (508) 429-6482.

CIRCLE 440 ON READER SERVICE CARD

All-In-One Business Package For New Users

NEW

More and more companies are trying to tap two elusive resources, the first-time user and the home market. With *Framework XE*, Ashton-Tate might not sway the home market, but small businesses and first-time users may want to look out for the company's latest software offering. *Framework XE* is the low-end version of the company's decision support software, *Framework III*. It's a combination of seven windows-style programs in one: word processing, spreadsheet, data management, outlining, telecommunications, and e-mail, plus a calendar, to-do list, and calculator. Users can view different windows simultaneously, then combine text, graphics, data, and spreadsheets into one document. The Quick



Framework XE exposes first-time users to business applications.

Start menu for first-time and occasional users consolidates the most frequently used functions into one menu. The word processor features an 80,000 word spell-checker, table of contents generation with page numbers, boiler plate text insertion, mail-merge capabilities, and a full range of character attributes including bold, underline, and italics. Among the

over 70 spreadsheet functions is the ability to link spreadsheets with other spreadsheets and/or graphs, and import/export dBASE data. Users can sort the database with an unlimited number of sort keys. Users can choose from several charts including: bar, stacked bar, line, scatter, x, y, and pie. With the telecommunications facilities users can access Dow Jones, CompuServe, MCI Mail, etc., as well as send and receive faxes.

List Price: *Framework XE*, \$149. **Requires:** 640K RAM, DOS 2.0 or later. Ashton-Tate Corp., 20101 Hamilton Ave., Torrance, CA 90509; (213) 329-8000.

CIRCLE 441 ON READER SERVICE CARD

800-Dot-Per-Inch Hand-Held Scanner

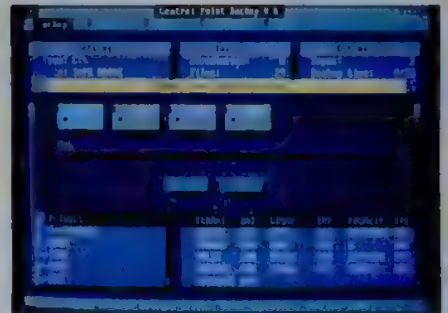
NEW

Marstek has begun shipping the M800, an 800-dpi gray-scale hand scanner for use with bundled software for DOS, *Microsoft Windows 3.0*, or the Macintosh. The M800 delivers 64 halftone gray levels and has 12 user-selectable halftone patterns. Resolution is switch-selectable from 100 to 800 dpi. It can handle images 4.13 inches wide and up to 24

CONTINUES ON PAGE 58

IMPROVED

Central Point Backup—Central Point Software has announced a standalone version of the backup program found in *PC Tools Deluxe 6.0*. *Central Point Backup* features an updated interface, and a built-in scheduler which lets users perform unattended backups. The program lets users save options and selections so they can launch subsequent backups from the DOS command line. *Central Point Backup* allows users to back up to floppies or to a tape backup system. The list price for *Central Point Backup* is \$99, with an optional upgrade to *PC Tools Deluxe* for an additional \$50. Contact Central Point Software Inc. in Beaverton, Oreg. at (503) 690-8090.



Retailing for \$99, **Central Point Backup** lets users back up to any drive.

Q+E, Version 2.5 for OS/2—Pioneer Software announced an OS/2 version of its *Microsoft Windows* database query tool. Fully integrated with Presentation Manager, *Q+E* promises to provide external database support to the IBM OS/2 Extended Edition Database Manager, *Microsoft SQL Server*, dBASE-compatible files, and ASCII text files. *Q+E* takes advantage of OS/2's Dynamic Data Exchange (DDE) and can run standalone or in conjunction with *Microsoft Excel*, *Lotus 1-2-3/G*, or any other OS/2 application. Users can access several databases simultaneously, manipulate data, extract information, and transfer data to other applications. *Q+E*, Version 2.5, with database support for text files, dBASE files, and the *Microsoft SQL* retails for \$149. *Q+E*, Version 2.5 with additional support for the IBM OS/2 Extended Database Manager retails for \$249 from Pioneer Software in Raleigh, N.C., (800) 876-3101 or (919) 859-2220.

CO/Session, Version 5.0—The remote control communications software product from Triton now allows users to control remote PCs with a mouse. Via modem or communications port, *CO/Session* works with standalone PCs or with PCs on a network to let users access applications which support the Microsoft Mouse and compatibles. Programs supported include *DESQview*, *Quattro Pro*, *First Publisher*, and *PC Tools 6.0*. With support for LIM EMS 4.0, expanded memory users can load the host package into high memory, reducing conventional memory to 5K. *DESQview* compatibility permits two remote users to run programs on a 386 PC in the background while a local user runs a program in the foreground. Other new features in Version 5.0 include a master password for the phone directory, multilevel security clearances, flexible modem handling for modifying modem settings, command line options for the remote package, and support for 43- and 50-line text modes. The suggested retail price for the host and remote packages are \$135 apiece. Together the packages retail for \$249. For upgrade information contact Triton Technologies in Iselin, N.J. at (201) 855-9440.

IconAuthor, Version 3.01—AimTech Corp.'s icon-based development tool for creating interactive, multimedia applications now features Rezolution, a *Microsoft Windows* utility that

CONTINUES ON PAGE 58



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In less than a year, Quattro® Pro has won over twenty international awards and has inspired more than a half million people to switch from their old spreadsheet. Now, with Quattro Pro 2.0, the best just gets better.

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*SQL data connectivity requires Paradox 3.5 and Paradox SQL, each sold separately. **Proof of ownership in an original page or disk from any version is required whether you purchase from Borland or your dealer. †This upgrade offer good through 12/31/90. ‡The ProShow PowerPack is sold separately. \$495 suggested retail price. \$39.95 suggested retail price. \$99.95 suggested retail price. © 1990 Borland Corporation. All rights reserved. Borland, the Borland logo, Quattro Pro, 1-2-3, Lotus, the Lotus logo, Turbo C++, Turbo Pascal, Sidekick, and the Paradox logo are registered trademarks of Borland Corporation. All other trademarks are the property of their respective owners. Borland Corporation, Copyright © 1990 Borland Corporation. Headquarters: 1500 Green Hills Road, P.O. Box 560001, Scotts Valley, CA 95051-0001. 408.438.3300. Offices in Australia, Germany, France, Switzerland, Italy, Japan, Sweden and the United Kingdom. 800.331.0877.

New&Improved

inches long. The DOS version, the M800 Plus, ships standard with *PC Paintbrush*, *CAT Reader OCR*, an interface card, and retails for \$459. *Windows* users can choose between the \$495 bundle featuring *Image-In* editing, grayscale processing, and OCR software or the \$595 M800W Plus, which ships with *Image-In* plus the *Perceive Personal* Omnifont OCR software package. Each M800 hand scanner features a one-year warranty.

List Price: M800 Plus for DOS, \$459; M800W for *Windows*, \$495; M800W Plus, \$595. Marstek Inc., 17795-F Skypark Circle, Irvine, CA 92714; (714) 833-7740.

CIRCLE 442 ON READER SERVICE CARD

LAN Solution For Small Businesses

NEW

US Sage has announced its Ethernet-based peer-to-peer network system for small- and medium-sized businesses. The MainLan Ethernet enables 10-megabit-per-second data transmission on personal computers connected for program sharing, file sharing, printer sharing, and e-mail. The product requires as little as 15K RAM in workstations using EMS. Priced at \$499, the MainLan Ethernet Starter Pack supports connection for two PCs and includes software, two Ethernet cards, 16.5 feet of coaxial cable, and Novell *NetWare* drivers. Additional MainLan Ethernet packs retail for \$199 per PC.

List Price: MainLan Ethernet Starter Pack, \$499. US Sage Inc., 2005 Tree Fork Ln., #113, Longwood, FL 32750; (800) 999-6770 or (407) 331-4400.

CIRCLE 443 ON READER SERVICE CARD

SX Laptop From Everex

NEW

Everex Systems unveils the Everex Tempo LX, a 16-MHz 386SX notebook for the \$3,899. Measuring 2 by 12 by 10 inches (HWD) and weighing 6.9 pounds, the Tempo LX supports up to 5MB RAM and features a high-density

The Tempo LX



CONTINUED FROM PAGE 56

converts an image from 8 to 16 colors, and to monochrome. Operating with .PCX files, *Rez* resolution features an image manager for viewing and manipulating several windows simultaneously, and automatically pastes to the clipboard viewer from any application. *Rez* resolution can convert an entire directory at once, and can enlarge, shrink, modify, and, according to AimTech, can manipulate images up to three times faster than *Paintbrush*. Other features include *Windows* 3.0 compatibility, enhanced memory access, context-sensitive help with hypertext, the ability to display 256 colors, additional full-motion video overlay capabilities, support for CD-Audio, and communications via Dynamic Data Exchange (DDE) and Dynamic Link Libraries (DLL). *IconAuthor*, Version 3.01, retails for \$1,395 with upgrades available for \$150 from AimTech in Nashua, N.H. at (800) 289-2884 or (603) 883-0220.

Developer's RenderMan, Version 3.1—Pixar announces that its toolkit will help software developers integrate photographic-quality 3-D picture making into Unix or DOS applications. The toolkit consists of photorealistic picture output software, a shading language, and scene description specifications. Users can create 3-D pictures that take into account visual attributes such as surface textures, motion blur, reflected light, multiple light sources, types of artificial light and natural light, plus other effects. Version 3.1 also features VectRMan draft-mode rendering, PostScript device drivers, tools for manipulating TIFF files, and reduced memory requirements. *Developer's RenderMan*, Version 3.1, retails for \$2,500. For upgrades contact Pixar in Pt. Richmond, Calif. at (415) 236-4000.

ARC+Plus, Version 7.1—System Enhancement Associates' popular file-compression utility has said goodbye to its cryptic command line interface and now boasts pull-down menus to guide users through all of the product's features. Unlike earlier versions, *ARC+Plus* is not shareware. The retail price for *ARC+Plus*, Version 7.1, is \$89.95. Users of any version of *ARC* or any other file-compression program may upgrade for \$34.95. Contact System Enhancement Associates in Clifton, N.J. by calling (201) 473-5153.

(CONTINUES ON PAGE 60)

3.5-inch floppy drive, a 23-millisecond 20MB hard disk, an 82-key keyboard, a three-hour nickel cadmium battery, and a 10-inch backlit LCD VGA with 16 shades of gray in standard 640-by-480 resolution or 32 gray scales in 320-by-200 resolution. The Tempo LX also has one parallel port, one serial port, one external VGA monitor port, and an internal slot for a modem.

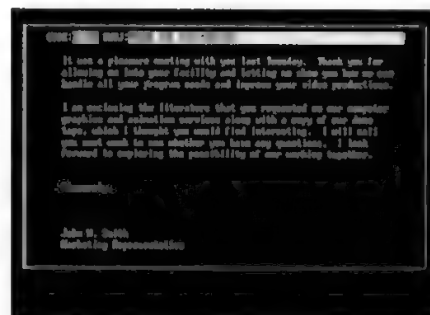
List Price: Tempo LX with 1MB RAM, 20MB hard disk, \$3,899. Everex Systems Inc., 48431 Millmont Dr., Fremont CA 94538; (415) 498-1111.

CIRCLE 444 ON READER SERVICE CARD

ThinkSoft Helps You Master Your Mail

NEW

ThinkSoft's Mail Master is a menu-driven office tool designed to help users automate business mail and personal correspondence. *Mail Master* ships with over 200 ready-made standard business letters which can be modified to fit specific situations. Sample letters are included for many aspects of advertising, customer relations, credit, collections, vendor relations, human resources, and more. The built-in word processor allows you to create and save your own letters, or you can import text from *WordPerfect* or other DOS word



Mail Master ships with a tome of ready-made letters which users can modify.

processors. *Mail Master* also provides a database to let users manage mailing lists, addresses, and other information on all business and personal contacts. Users can categorize and sort lists, customize labels for special attention, and maintain records of all their correspondence. You can group correspondence by location, project, department, subject, company, or by any other criteria. To avoid sending duplicate letters or double correspondence to an important customer, *Mail Master* automatically eliminates duplicate names. **List Price:** *Mail Master*, \$99.95. **Requires:** 512K RAM, hard disk, DOS 2.0 or later. ThinkSoft Corp., 1220 Broadway, #604, New York, NY 10001; (800) 533-3466 or (212) 268-5600.

CIRCLE 445 ON READER SERVICE CARD

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—Reprinted from *PC Magazine*, August 1990

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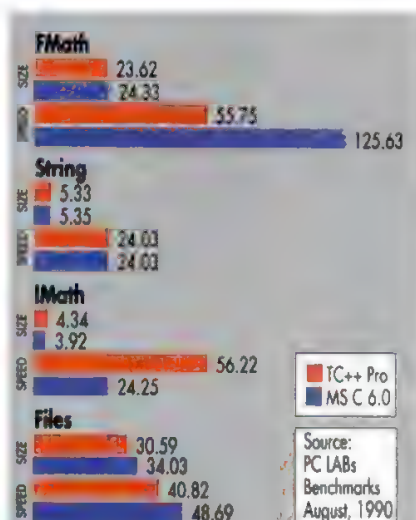
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Integrated debugging	NO	YES
TOOLS		
Debugger	YES	YES
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Macro assembler	NO	YES

Turbo C++ Professional beats Microsoft C 6.0.



Performance results:
.EXE size given in kilobytes, speed given in seconds.

Using a 16MHz 386, HIMEM driver and PC-DOS 3.3. Hard disk and RAM disk optimized between tests, compiled benchmark programs run from RAM disk. Each compiler was optimized for speed.

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New&Improved

Fashion-Oriented Bar Code Design

NEW

Seeing the need for elegant yet functional bar codes, **Integrated Software Design** introduces *Barney Ellis*, a PC-based software package which integrates graphics design with database management for printing labels, forms, signs, and bar codes. The label, form, and sign design screen is true WYSIWYG, and features a customizable ruler (adjustable in inches, centimeters, or point sizes). By clicking the mouse, the user can expand or shrink designs on-screen and rotate fields in four directions. *Barney Ellis* ships with 101 bitmapped fonts, and all standard bar code symbologies. Additional libraries of fonts, logos, and pictures—including scalable and customized ones—are also available. Users can draw designs on-screen, or import .PCX files produced by other applications. Once a form is designed, users can work with fixed and fill-in fields, and may enter data through the keyboard, from a database, or from an ASCII file. Users can prioritize queue and batch jobs in order to achieve unattended printing on up to four printers. The set-up feature allows the user to customize *Barney* and to access other software from within the package through icons. For example, if the user wants to use PC

Paintbrush instead of *Barney's* drawing tool, the user can set the Draw icon to act as a WYSIWYG hotkey.

List Price: *Barney Ellis*, \$1,695. **Requires:** 640K RAM, DOS 3.x or later. Integrated Software Design Inc., 171 Forbes Blvd., Mansfield, MA 02048; (508) 339-4928.

CIRCLE 446 ON READER SERVICE CARD

New Dot Matrix From NEC

NEW

NEC Technologies adds three printers to its 24-wire dot matrix line: the Pinwriter models P3200, P3300, and P9300. Priced at \$429 and \$599 respectively, the P3200 and P3300 are built-in pull-tractor-feed printers designed for small business environments and the student market.

They feature seven resident fonts, including a proprietary Quick Gothic font that promises letter-quality output at 108 characters per second. The other fonts print at 216 cps in draft and at 72 cps in letter-quality mode. The P3200/3300 also feature an 8K buffer, print resolutions up to 360 by 360 dpi, and provide Epson LQ emulation, standard parallel interfaces, plus optional serial interface and pull tractor options. NEC claims the design of the P3200/P3300 allows for an operating noise level of 52 dBA.

The Pinwriter P9300, priced at \$1,395, promises 4-page-per-minute letter-quality throughput on everything from six-part and

continuous forms to labels, envelopes, and transparencies. It has eight resident fonts (including Quick Gothic at 200 cps), an 80K buffer, Epson LQ emulation, parallel interface, multistrike film ribbon, and built-in color capabilities.

List Price: P3200, \$429; P3300, \$599; P9300, \$1,395. **NEC Technologies Inc.**, 1414 Massachusetts Ave., Boxborough, MA 01719; (508) 264-8000.

CIRCLE 447 ON READER SERVICE CARD

\$139 Fax/Modem From Twincom

NEW

Image Communications introduces the Twincom 24/96, a \$139 internal modem with send and receive fax capabilities. As a 2,400-bps modem, the Twincom features auto-answer/dial, *Quick Link II Fax* software with pull-down menus and mouse support, seven file-transfer protocols, and auto log-on scripting and macros. As a 9,600-bps Group III fax, the Twincom features automatic receive and print capability, background send/receive operation, delayed transmission, auto-answer/re-dial, fax cover page and letterhead merge capability, a fine mode of 200 dpi, archive compression of fax files, and support for multiple file formats including ASCII, .PCX, and .TIF. **List Price:** Twincom 24/96, \$139. **Requires:** 640K RAM, hard disk, DOS 3.0 or later. **Image Communications**, 6 Caesar Pl., Moonachie, NJ 07074; (800) 666-2496 or (201) 935-8880.

CIRCLE 448 ON READER SERVICE CARD

Read/Write ISO/SCSI Optical Storage

NEW

Iomega Corp. has announced the LaserSafe, a 650MB erasable optical storage system for the PC which promises full ISO and SCSI compatibility. Using the SCSI interface, the LaserSafe connects with ISA, EISA, and Micro Channel computers running OS/2, Unix, and NetWare 286. With the implementation of 256K dual-ported read/write caching and asynchronous writing techniques, the LaserSafe promises SCSI transfer rates of 1.4MB per second, and disk transfer rates up to 5.5MB per second. The LaserSafe writes to removable 5.25-inch optical disks which provide either 590MB or 650MB of storage depending on the sector size chosen.

List Price: LaserSafe, \$4,999; cartridges, \$299. **Iomega Corp.**, 1821 W. 400 South, Roy, Utah 84067; (801) 778-3345.

CIRCLE 449 ON READER SERVICE CARD

IMPROVED

CONTINUED FROM PAGE 58

Smalltalk/V Windows—Digitalk has combined its object-oriented programming environment with *Microsoft Windows 3.0*. *Smalltalk/V Windows* has all the features found in previous versions; users can use the browsers, inspectors, and push-button debuggers to navigate *Smalltalk/V* code and the *Windows* environment. In addition, *Smalltalk/V Windows* provides an interface to *Windows'* Dynamic Data Exchange (DDE) and to the Dynamic Link Library (DLL), allowing *Smalltalk/V* to share information with other applications and to call applications outside of the program. The *Windows* version's source code is fully compatible with Digitalk's existing *Smalltalk/V PM* programming environment. This allows developers to choose either system as a development platform and deliver their applications on both systems simultaneously. *Smalltalk/V Windows* retails for \$499.95. For upgrades contact Digitalk Inc. in Los Angeles, Calif. at (213) 645-1082.

Timeslips III, Version 4.0—The Timeslips Corp.'s time tracking, billing, and productivity reporting software now features automated functions, increased security, and expanded reporting functions. For security purposes, Version 4.0 lets a systems administrator define up to eight user groups, each with its own password and rights to 27 secured operations. User-defined client reports contain data on client history such as address, balance, date of last bill, etc. Client budget worksheets enable users to compare historical data and work-in-progress versus the budgeted amount. Bills can now be user-defined to print out only the portions that the user desires. With the transaction entry feature, the amount due is automatically placed in the payment amount. Only those payments that differ from the current balance must be entered. The auto-pay feature enables users to designate an automatic payment from the clients funds to the balance. *Timeslips III 4.0* retails for \$299.95 for a single user and \$699.95 for the network edition. For upgrades contact Timeslips Corp. in Essex, Mass. at (508) 768-6100.



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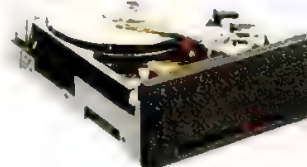
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 - 4MB RAM
 - 200MB 15MS IDE Hard Drive w/ 32K Cache
 - 1.2MB 5.25" Floppy Drive
 - 1.44MB 3.5" Floppy Drive
 - 16 Bit VGA Card w/ 512K RAM
- Add \$150 for vertical CPU case.

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- 14" Sony Trinitron 1024x768 Super VGA Monitor
- Microsoft Mouse
- Microsoft Windows 3.0
- MS-DOS 4.01 or 3.3
- Ultra-Click 101 Key Keyboard
- 1 Parallel & 2 Serial Ports

ULTRA 386-25

- 64K 25NS Static RAM Cache
 - 4MB RAM
 - 200MB 15MS IDE Hard Drive w/ 32K Cache
 - 1.2MB 5.25" Floppy Drive
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- Add \$150 for vertical CPU case.

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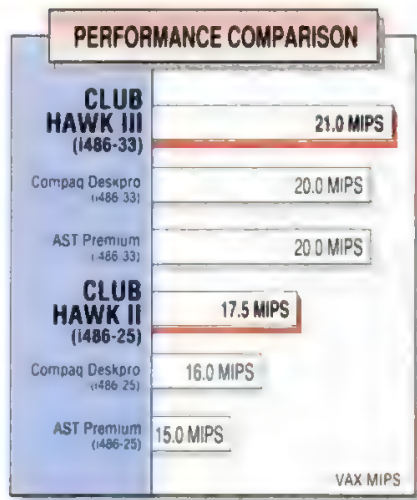


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PC World, Best Buy Award 1989

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edited by
Matthew J. Ross

Read Only

Reviews of the Latest Books for the PC User

Finding Shareware In Two Easy Lessons

Shareware applications and utilities are often as good or better than their commercial counterparts. Many essential utilities can be found only among the hundreds of shareware or public-domain programs available on BBSs and on-line services, and not in commercial packages at all. But unless you spend hours haunting the BBSs, you have no way of knowing which shareware program to choose over dozens of possible alternatives.

Authors of commercial programs buy ads to let you know they exist. Shareware authors have to depend on word of mouth. That's why it makes sense to look into two new compendiums of information about shareware.

■ *The Source Book of Free and Low-Cost Software*, second edition by Nelson Ford
Public (software) Library, \$19.95
Nelson Ford's *The Source Book of Free and Low-Cost Software*, now in its second edition, is by far the most thorough and reliable guide to shareware and freeware available anywhere. This book is officially the catalog of the Public (software) Library, the leading mail-order source of low-cost software, and the one that most rigorously tests and reviews programs before offering them to the public.

The Source Book packs brief descriptions of over 4,000 programs into its 600 double-columned pages. Every category of software is listed, from accounting programs through soft fonts to biblical texts on disk. Four disks full of supplementary listings come with the book,



The Source Book: quick access to low cost software.

and you can get free updates of these disks by returning them when you send a disk order to the Public (software) Library.

The reviews in the *Source Book* are brief but accurate, and if you prefer to get your software from a BBS instead of by mail, you can use the book as a guide for programs to look for during your late-night hours on-line. This is a book for anyone who wants the best possible software and doesn't care where it comes from.

The Public (software) Library,
Houston, TX 77235; (800) 242-4775,
(713) 524-6394.

ISBN 0-9623453-2-6

CIRCLE 411 ON READER SERVICE CARD

■ *Dr. File Finder's Guide to Shareware* by Mike Callahan and Nick Anis
Osborne McGraw-Hill, \$39.95 (includes one disk)
Mike Callahan, who calls himself Dr. File Finder, runs a BBS that's well known as a clearing house for shareware. *Dr. File Finder's Guide to Shareware*, written with Nick Anis, is a collection of the good doctor's wisdom accumulated during years

exploring the riches of hundreds of BBSs.

Unlike *The Source Book*, which consists entirely of brief descriptions and reviews, Callahan and Anis's book mixes detailed descriptions of over a hundred programs with a history of shareware and advice on accessing bulletin boards and downloading programs. An included disk features a shareware batch file enhancer, text editor, file manager, and disk catalog. The book's cover says the disk also includes *Qmodem*, *BackMail*, and other programs; it doesn't, although a coupon inside lets you order two more disks with these and other programs at no charge. A list of BBSs (with notes on Callahan's favorites) helps you find a local source for the programs in the book.

The authors seem as interested in the shareware process as they are by the programs themselves. They begin their book with careful definitions of shareware, freeware, demoware, etc., followed by historical accounts of shareware pioneers, interviews with today's prominent authors, and a history of the recent wars conducted on BBSs between rival file-compression protocols. If you're interested in shareware as a kind of alternate culture, you'll be fascinated by all this. If you simply want to find the right program to get a job done, it can seem like needless filler.

Dr. File Finder is most useful when it describes shareware programs. The book devotes as many as a half-dozen pages and three screen shots to the most important shareware programs, and a

paragraph or more to dozens of small utilities. Although brief, the descriptions are detailed enough to give you a feel for the program. The screen shots give you a sense of whether a program is dense and complex, or spare and elegant—and can give you a good idea of which programs you might want to try out. Hundreds of other programs and text files are listed in the form of directories with one-line comments taken directly from BBSs.

Although the detailed program descriptions can be valuable, they often omit the unique feature that might make you choose one program over another—for example, the Boyan communications program's ability to capture from the screen the name of the file



you want to download. The descriptions, too, are overwhelmingly repetitive. A good editor could have compressed this book to two-thirds its length without sacrificing any information.

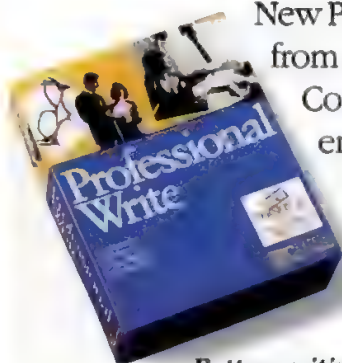
A good editor could also have trapped some amazing errors, like the statement that you can't type more than 15 characters at the DOS command line unless you use a utility to expand the keyboard buffer. But the program descriptions make this book a valuable guide, and the history and philosophy of shareware has never been expressed as eloquently as in Callahan and Anis's opening pages.—Edward Mendelson
Osborne McGraw-Hill, Berkeley, CA
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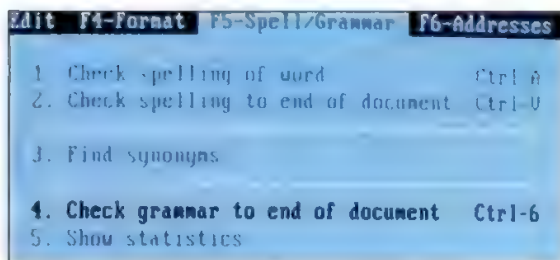
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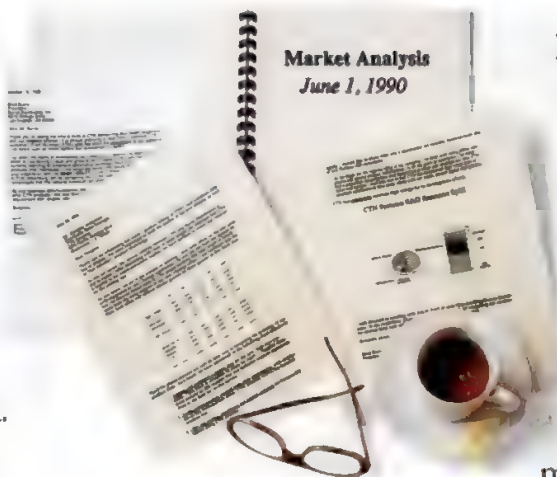
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Pipeline

A Look at the Trends Shaping the Personal Computer Market

Lotus Acquires Samna, Looks for Synergy Between Amí and 1-2-3

Lotus has finally found a willing partner. After the aborted attempt to merge with Novell earlier this year, Lotus's acquisition of Samna seems anticlimactic.

This time, both companies got approval from their respective board of directors before making it public, and the two parties give every sign that this will be a harmonious union.

The ramifications aren't major. Both WordPerfect and Microsoft are keenly watching for any signs that Lotus may be able to lift Amí into the big time, but there's unlikely to be a major shift in the word processing balance of power any time soon. The merger will certainly keep the pressure on WordPerfect to deliver its Windows edition on schedule; it has currently planned a release before April '91.

Samna should help Lotus gain more expertise in Windows programming. For the time being,

Samna will operate as it has in Atlanta and will act as Lotus's word processing division. The decision on whether Lotus Manu-

ning under OS/2 and Windows share data. CDP will help all applications achieve the kind of integration that Lotus and WordPerfect said the companies had achieved between the graphic versions of their leading software programs.

In short, CDP will let you merge files from separate programs that conform to the spec,

links possible. CDP will help make these links transparent to users because it will be an automatic feature of most data files.

The Lotus-Samna merger could undermine the effort to prepare a similar protocol called Intelligent Snapshot Driver. Samna, Micrografx, Corel Systems Corp. and other Windows programmers began work on this protocol to achieve roughly the same goal as CDP would provide, but it's being developed by the group without Microsoft's participation.

Lotus has been active in CDP development work, as has its new rival, WordPerfect. Lotus's interest in CDP goes beyond the need to protect the .WK1 file format's number one status; Lotus Notes desperately needs this kind of link with other data formats if it's to succeed.

The Lotus-Samna union will help advance the Compound Document Protocol (CDP) specification that is supposed to help applications running under OS/2 and Windows share data.

script will live or die is being left to Samna's management; Manuscript has an installed base of about 50,000 users.

On a technical level, the union will help advance the Compound Document Protocol (CDP) specification that is supposed to help applications run-

ning without going through a translation. Once the files are merged, the data will remain live, so that changes made to either document will be reflected in both files.

CDP is really an extension of Dynamic Data Exchange (DDE), the specification that makes hot-

XGA KEEPS IBM ONE STEP AHEAD

Just as IBM is enhancing the 8514 graphics standard with XGA, the companies that created Super VGA are finally about to endorse 8514.

CONTINUES ON PAGE 68

SURVEY

Peripheral sharing isn't the most glamorous topic covered in *PC Magazine*, but it is important to a lot of readers. When we told callers to PC MagNet that we were taking a survey on the topic, 1,042 people responded. 66 percent said that they did use some of the available products for sharing peripherals; not surprisingly, Fifth Generation's *Logical Connection* was the head-and-shoulders leader.

To help us understand what readers look for when they evaluate new devices, we asked them to rate their interest in several possible features.

User-upgradable memory

33
52
12
2

File transfer software

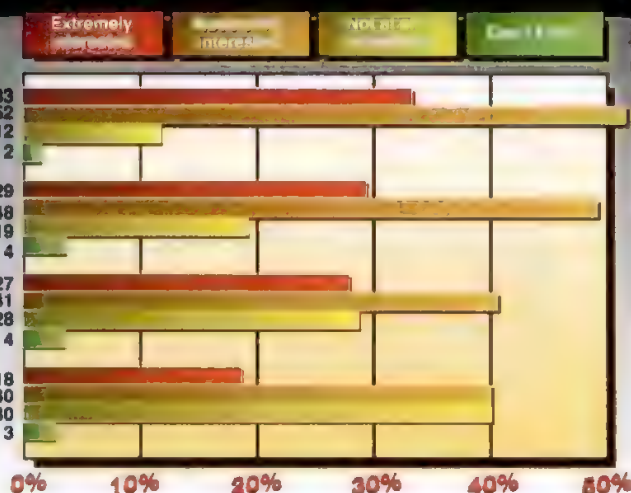
29
48
19
4

Background file sharing

27
41
28
4

E-mail

18
40
40
3



Pipeline

CONTINUED FROM PAGE 67

For the last couple of years, companies like Paradise, Video Seven, and ATI were too busy enhancing VGA with 800 by 600 modes to worry about 8514 boards. But ironically, they've been gearing up plans to market the 8514 standard just as IBM's ready to move beyond it.

The key weakness of IBM's 8514 display system is the use of interlacing, which cuts the number of video lines in half; it's a technique that saves on costs but results in a picture that's less crisp than you'd see on a noninterlaced display. Interlacing is also used in IBM's XGA displays.

Just as IBM is enhancing 8514, the companies that created Super VGA are finally about to endorse it.

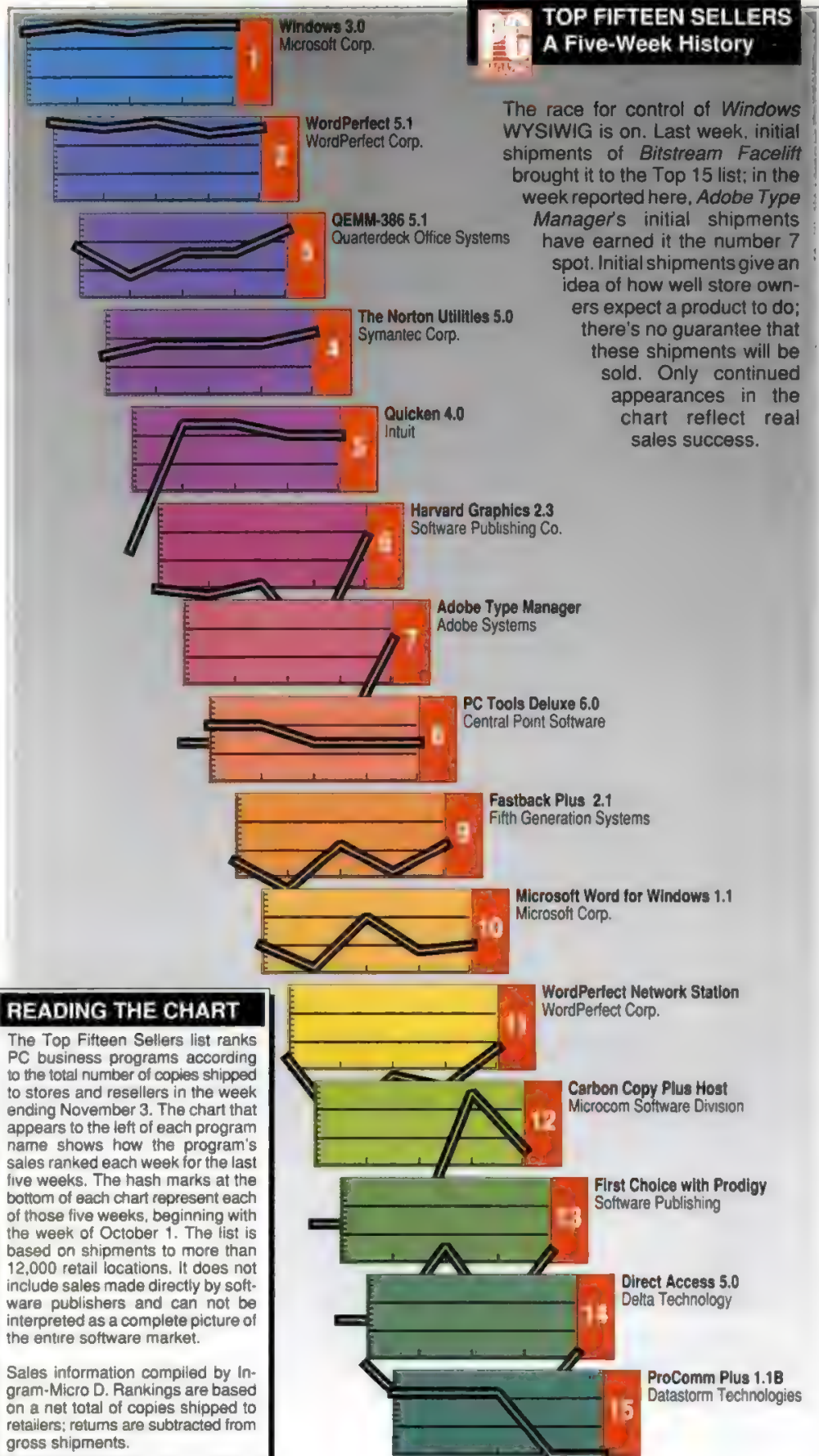
8514 color graphics systems from people other than IBM are more likely to use noninterlaced displays so they'll be more appealing; it goes without saying they'll be less expensive than IBM's offering.

The real question: is the world ready for a video standard beyond Super VGA?

Once the rest of the market starts heavily promoting noninterlaced 8514, you're likely to see IBM replace its XGA specification with one that drives a noninterlaced display. Mitsubishi is under contract to IBM to build the monitors; all IBM needs to see is market demand. (See page 34 for details on IBM's introduction of XGA.)

THE RISE OF HANDWRITING RECOGNITION CONTINUES GRiD Systems has been a leader in bringing handwriting recog-

CONTINUES ON PAGE 71



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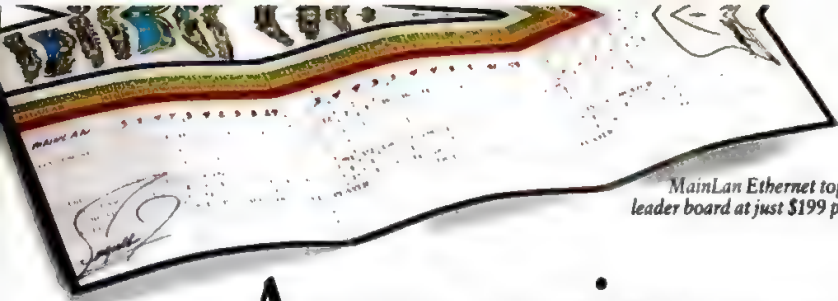


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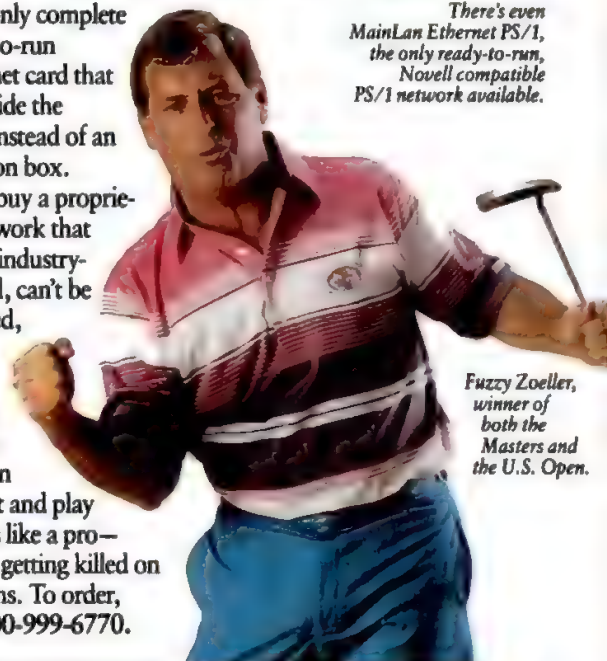
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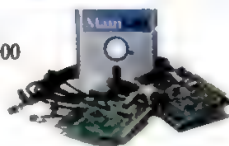
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MainLan Ethernet requires as little as 15K of RAM for workstations. *MainLan 386 Ethernet available January 1991. All company and product names are trademarks or registered trademarks of their respective owners.

Pipeline

CONTINUED FROM PAGE 68

dition to a PC. The GRiDPad, a portable that doesn't have a keyboard, is used for data entry in customized DOS-compatible applications.

Now GRiD is introducing a light pen that lets desktops use GRiDPad applications. Only block letters are understood and no links to existing commercial applications are available. The GRiDPad and the new light pen are suitable mainly as data collec-

**NMB Technologies has
started shipping
the fastest RAM chips yet:
53 nanoseconds.**

tion in the field, using programs specifically written for the device.

This move comes as Go Corp. puts the finishing touches on a system it plans to introduce in January. Meanwhile, Microsoft is hinting that it will be able to add handwriting recognition features to *Windows* in a future release.

UNAUTHORIZED SOFTWARE RENTAL MADE A FEDERAL OFFENSE

A few years ago, several entrepreneurs thought they had a surefire moneymaking scheme: software rentals.

Software publishers were not amused. They succeeded in putting such operations out of business with the threat of legal action, and they've now succeeded in getting a bill through Congress that goes beyond basic copyright protections. The Software Rental Amendments Act specifically prohibits the rental or lending of commercial software without the express permission of the copyright holder.

The law will not affect commercial software that is being leased by an authorized licensor.

NEW RAM SPEED RECORD SET: 53 NS.

NMB Technologies has started shipping the fastest RAM chips yet: 1-megabit and 256K CMOS DRAM chips with ratings of 53 nanoseconds.

The company says the faster speeds will enable 16-MHz and 20-MHz 386 PCs to be designed without interleaved memory schemes. It said tests show that a 20-MHz 386SX system with the 53-nanosecond DRAMs ran 25 percent faster than a similar system using 80-ns. DRAMs in a dual-bank interleaved arrangement. ■

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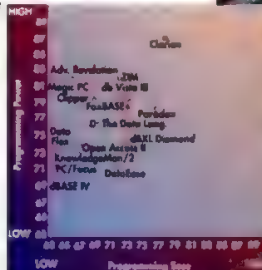
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Here's what American corporations in a PC Week survey thought of the power and ease of use of Professional Developer vs. competitors



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THE LEADER IN WINDOWS 3.0 GRAPHICS

Bill Machrone



Desktop Downsizing

Personal computers shouldn't be seen or heard. But they should be powerful.

I had a personal computer in my home long before I ever had one at work. The system unit had 20 slots. It needed them, considering that the memory boards held only 64K each. I had eight memory boards, and therefore was considered a showoff by my friends and associates. The power supply took up half the case and put out enough current at 5 volts for light welding. The transformer was large enough to anchor a small dinghy. Dual 5-inch fans kept the computer cool. It covered about a third of my desk and didn't even hold the disk drives. They lived upstairs in a similar-sized case: two 8-inch, 1.2MB floppies—state of the art. They

spun all the time, whether they were being accessed or not, and had their own power supply and fan. An ASCII terminal and keyboard graced the center of my desk, leaving a small patch to the

left for my papers and printouts. My NEC Spinwriter stood on a sturdy steel-and-formica table into which I had cut a slot for bottom-feeding the paper. The printer shook the house when it ran and could be heard in every room. The combined noise and heat of this setup should have been grounds for filing an environmental impact statement every time it was turned on.

Today, I have a Compaq Deskpro 386 on that same desk. It still takes up a third of the desk, but it holds a 40MB hard disk, 6MB of RAM, and sports a 16-MHz 386 processor. It drives an HP LaserJet II. The combination of the fan and hard disk, while not as loud as the old boat anchor, is sufficient to make the kids turn up the TV set. It's been a good, serviceable computer, but its days are numbered.

(NEARLY) SILENT GUESTS

Two recent visitors to the den have radically shifted my opinion of what a personal computer should be. The first is the IBM PS/1. It came in one box. My five-year-old put it together. It takes up less than half of one of those oak, 2-foot by 3-foot kid's tables. It's quiet enough that you can't even hear it over the din made by the Compaq machine. Better, it's

quiet enough for electronic music.

I have a MIDI port in the PS/1 and one in the Compaq. But using the Compaq for music is like running a hair dryer while listening to the stereo. I don't like my music loud, and I'd like to play along, sing, and perhaps record my efforts without that droning whine in the background. On the other hand, the PS/1 is quiet enough to be unobtrusive, but its MIDI adapter is nonstandard. It's not compatible with the Roland MPU-401, the de facto standard for MIDI adapters in the PC marketplace, which limits the number of MIDI software products that work with it. Enter my next guest.

You've probably seen the ads for the Ergo Brick—that delightfully small, full-featured 386SX machine. Ergo sent me one for evaluation, together with a nylon carrying case, so I carried it home. The Brick has a full complement of I/O ports, plus a built-in modem. As a result, its two expansion slots are all you'll likely ever need. The Brick uses its metal case as a heat sink and has a thermostatically controlled fan. My test unit has 8MB of RAM and a 212MB hard disk—and the fan hasn't come on yet. The case gets only a few degrees warmer than room temperature, certainly no warmer

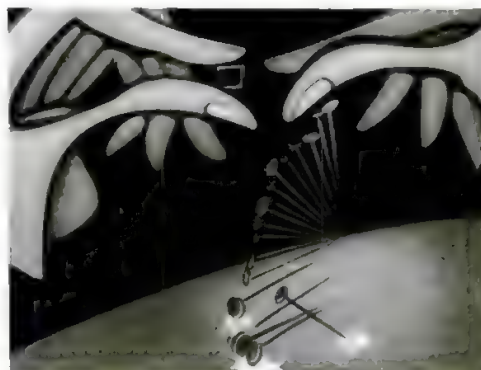
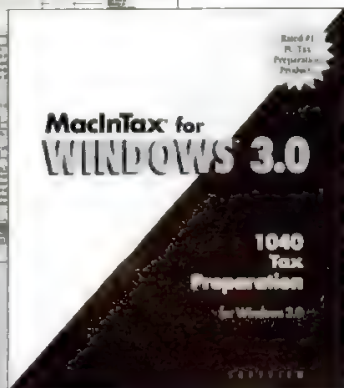
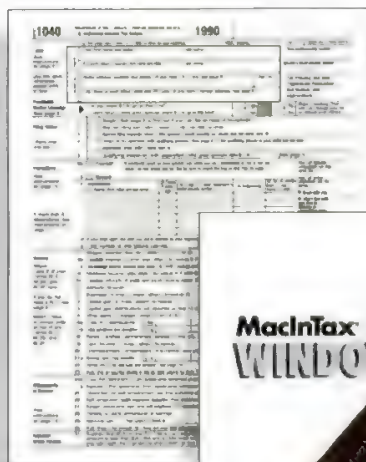


ILLUSTRATION: SHANNON JEFFRIES

than a VCR. It's even a little quieter than my VCR, and, with a CMS 401-compatible board installed, is an ideal music workstation. It's almost silent, it's fast, and Super VGA is built right onto the motherboard—a boon to all the music software that requires *Microsoft Windows 3.0*. It's a great personal computer in every other respect, too. It takes up minimal desk space, it's both rugged and stylish, and it's extremely fast.

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S O F T V I E W

Bill Machrone

DESKTOP DINOSAURS

Consider the above an example of the general direction that laptop and notebook computers are taking, and you can see that the classic PC is an anachronism. Most of the things that we currently have on expansion boards belong on the motherboard: serial ports, parallel ports, mouse ports, even the modem. IDE hard disk controllers have gotten the size down and the performance up, so that standalone hard disk controllers are superfluous on all machines but file servers. Now that VGA is the norm for laptops, they're encroaching on desktop applications. With LAN adapters that run off the parallel port, there's little need for expansion. Portables even confer other benefits: Every battery-powered system comes equipped with a built-in uninterruptible power supply. Power consumption is minimal, and noise is nonexistent. Also, in case anyone ever proves any of the suspicions about monitor radiation, LCD displays are free of the low-frequency electromagnetic radiation, high-voltage static fields, and magnetic fields that accompany CRTs.

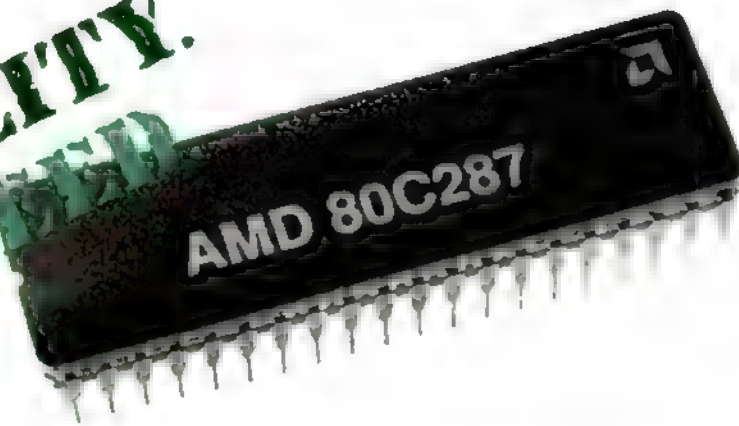
Another potential space saver is the mouse. You need to devote a good hundred square inches to using most mice, which is a lot on most desks. I usually have to clear space for mine, to turn back the tide of paper. Lately, though, I've been using the MousePen. It's been a good companion for the Brick, but it's even better for use with a portable. It's perfectly happy with only 9 square inches, the size of a Post-it.

The office is a fairly noisy environment, what with blower systems, office machinery, paging systems, Muzak, and telephones ringing. We won't get any pity from the folks who work out on the shop floor, but there's no reason for our PCs to add to the din. We work in closer proximity to our PCs than any other office implement except the telephone. The phone is inert until it rings or you use it. The PC should not impinge, either.

Small machines have been second-class citizens too long. They've been associated with diskless workstations and people who couldn't be trusted to have a hard disk, much less expansion slots. All that has changed. Gloria Vanderbilt once said that you can't be too thin or too rich. PCs can't be too small or too powerful. And they're not mutually exclusive any more. ■

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John C. Dvorak



CD-ROM: Still a Bust

The current combination of noncompatible hardware and proprietary software makes CD-ROM on your PC one giant headache.

Something stinks here. After a half year of trying and trying to get a reliable CD-ROM system to work on my otherwise reliable Silicon Valley Computers 486, I finally got it running. I don't want to discuss how many vendors have shown me systems "guaranteed to work." None ever tried their products on a 486. They just say, "It should work!"

Well, it doesn't. A lot of things don't work, and no one out there tests across a wide enough variety of machines. Even big companies aren't checking enough new machines. For example, as far as I know I was the only one who tested *Windows 3.0* on a 486 in the entire *Windows* beta-test program. The install program didn't work right on the 486. Nobody knows why. Nobody ever figured it out. Eventually the installation problem was solved. Nobody knows how.

The 486 is the next-generation personal computer. High-performance software such as *Windows* and high-tech concepts such as CD-ROM should work first with machines based on newer chips, not on the old dogs.

The CD-ROM situation is so bad that I never got one to work right on my Everex 25-MHz 386, let alone the 486. I once had an older Hitachi CD-ROM work properly with an AT, but since then it's been a miserable struggle. The design engineers I talk to blame the SCSI port. "SCSI doesn't work. It's a bitch," they say. Most CD-ROM controllers are SCSI. I've complained before about these problems and was pleased to receive a memo from superstar programmer Bob Frankston who said, "Gee, I thought it was just me."

Well, my current CD-ROM drive is a new Hitachi model using drivers I haven't seen before. This system is marketed by Sun Moon Star and comes bundled with a slew of CD-ROM disks. The Sun Moon Star people specialize in incorporating CD-ROMs into their systems to differentiate them. They seem to know what they're doing. Maybe there is hope after all.

Still, I have to disable the 486's on-chip cache to get the system to work. On this particular 486 I can turn off the cache with a turbo

button on the front panel, so it's no big deal. It's just a nuisance. I'm told there are timing problems associated with slow SCSI or other bus cards, or maybe the self-modifying code is interfering with the functionality of the on-board cache of the 486. *Sigh.*

It gets worse. I finally got to look at the slew of CD-ROM disks I've been accumulating. Guess what? The software is a mess!

After the tenth disk I wondered if the vendors are missing the point. Gads. Each one has a different file format and a different search engine. Each vendor wants you to dedicate a subdirectory and a bundle of megs to a given disk, and each disk requires a screwball path statement, a driver, or some memory-chewing crap-ola to operate properly. If you routinely used more than a few CD-ROM disks, your system would be chewed up by ancillary files and memory hogging TSRs.

While I haven't seen much moaning about this phenomenon, it's a terrible situation. Maybe nobody uses more than one or two CD-ROM disks, ever! Maybe they already know it's next to impossible. Go look at 20 or 30 disks at one sitting and you'll see that the software is a laugh. It's the most impractical



implementation of any technology imaginable. Luckily CD-ROM isn't too popular yet. There may be a solution.

We need a *Magellan* for CD-ROM. An *Über*-program that does it all and avoids using built-in search engines and file organizers. One that finds everything and creates a common user interface for all the disks in your CD-ROM collection. Sign me up. The CD-ROM scene will worsen unless this happens soon.

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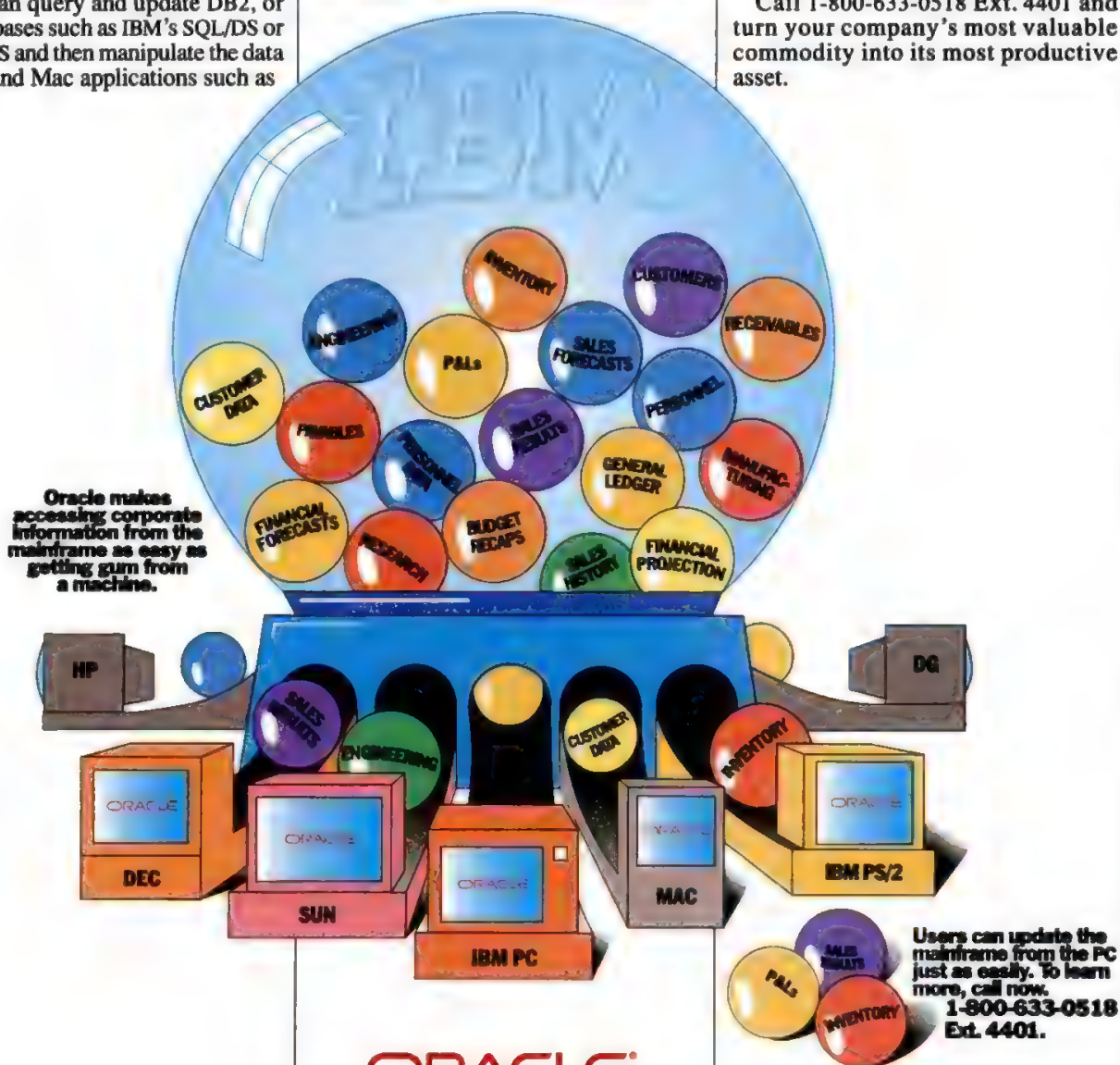
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Inside Track

The **biggest news** in the industry was the decision of Superior Court Judge J. Barton Phelps in favor of **AMD over Intel** in

recent litigation. The ruling paves the way for Intel to fork over the 80386 license, which Advanced Micro Designs says Intel is obliged to grant. In a **nasty reference** to Intel's dealings, Judge Phelps is quoted as saying that Intel's conduct in its relations with AMD is a "classic example of breach of the covenant of good faith and fair dealing, preaching good faith but practicing duplicity."

Sounds like the **semiconductor business** to me, and par for the course.

Oh, Noah! Laptop Flood Coming Dept.: The possibility that the 386 will be licensed comes not a moment too soon as the Taiwanese have geared up their factories to produce **cheap laptops** utilizing the 386SX. Recent publications from Asia indicate that perhaps **500 different laptop models** are about to hit the market. Bill Machrone told me that hundreds and hundreds of laptops have already been submitted to PC Labs for inclusion in *PC Magazine's* upcoming March Laptop **blockbuster** issue.

Hot New Flat-Panel Technology: A curious article in *Aviation Week and Space Technology* discussed a **totally new flat-panel display** methodology from Tektronix. It's called a **plasma-addressed liquid crystal display**, or PALC. A 4-foot square, 2-inch thick screen can easily be designed around this technology. While the current state-of-the-art TFT display (thin-film transistor) requires a transistor behind each pixel—limiting screen size and significantly lowering the production yield—this new technology is geared toward **bigger screens** and higher yields.

This announcement appeared in the "insiders" magazine, *Aviation Week and Space Technology*, to seal some sort of arrangement with DARPA (the Defense Advanced Research Projects Agency) and perhaps **excite** some interest. There's an indication that the project is not getting **the funds** it needs or deserves. My comment: it's about time we did something new! It's obvious that TFT-type flat-panel color screens are going no further than the little television screens found on the **Sony 8-mm. video Watchman**. The yields are too low. The technology is already strained, and there are **no breakthroughs** in sight. I'm told that a large, flat-panel, full-color display may actually cost \$10,000 to make when the low yields are accounted for.

The initial size of these new PALC screens is 17 inches right out of the chute. One critical friend of mine wonders why

this potentially superior technology is **begging for money** while IBM and other American firms are **funneling millions** to

the Japanese so they can develop a superior flat-panel screen. He says, "The Department of Defense isn't too pleased with money going overseas to develop display technology there."

Genuinely Interesting Software Dept.: After this year's Las Vegas Comdex a slew of losers came back from the **blackjack tables** unable to break even on a game designed for **smart players** to do well. Order a copy of *The Serious*

Blackjack Tutor from Blachly Data Systems. It'll be the best \$27.95 (plus \$3 shipping and handling) you'll ever spend. While not the most graphically interesting card game I've ever seen, it plays outstanding blackjack and coaches you in classic blackjack play. This is not a card-counting system, but the **legal** and proven classic methodology. If you even think of gambling, you must buy this program. It will pay for itself and make you look like you know what you're doing. **The Serious Blackjack Tutor** comes with an unconditional **money-back guarantee too!** Blachly Data Systems, 148 W. 23rd St. #7A, New York, NY 10011; (212) 255-4033. Dare I say: Hot stuff!

Joke of the Month Dept.: It's hard to find good computer jokes. Perhaps this one is an exception. The computer company president says to the quality control manager, "Jim, last month I told you that our computers are shipping in terrible shape. The motherboards are warped, there are missing chips, the power supplies all

blow up. Two weeks ago I told you that it was getting worse. The printer ports aren't wired, the disk drives are all faulty, the keyboard has missing keys. Last week I told you that the **screws** don't fit anywhere, the front pieces all fall off and the software we supply is all **bootlegged**. Yesterday, I discovered that the video cards don't work, the serial port is short circuited and the case is grounded improperly and six people have already been **electrocuted**. One more problem and you're fired!"

Microsoft Story Dept.: At a recent meeting of the Orange County Computer Club, a Microsoft speaker **extolling** the virtues of *Microsoft Works* wanted some audience participation and asked the large group, "What is Microsoft best known for?" A **joker in the back** rose and shouted: "The 640K barrier!" This brought **howls** from the audience. I don't think that they ever found out what the speaker thought Microsoft was best known for. Any ideas? BASIC? *Flight Simulator*? ■

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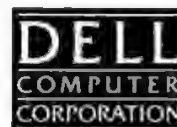
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Jim Seymour



Do Graphical Results Require a Graphical Interface?

Yesterday's popular graphics packages may not run under Windows, but that doesn't mean they're no longer useful.

They're anomalies, to be sure: nongraphical PC graphics programs. But anachronisms? I'm not so sure.

It's an article of faith in the PC business these days that the high-riding charting packages of the last few years—Software Publishing's *Harvard Graphics*, Lotus's *Freelance*, and Ashton-Tate's *Applause II*—are about to get killed by a stampede of customers who are running to Windows-based charting programs.

In other words, graphical graphics software will destroy them.

I think the notion that these market leaders are about to disappear is nonsense. The new

Windows programs, such as Micrografx's *Charisma*, Microsoft's *PowerPoint* and Aldus's *Persuasion* (the latter, just starting to ship), are powerful packages. I use them myself, and I certainly think they're going to be successful.

But to suggest that Corporate America—after years of using charting and graphics programs that don't use a standardized graphical interface—is going to switch overnight to Windows graphics packages is loony.

First, there's the huge installed base of happy users of those programs. The impact of a large, satisfied and trained installed base is almost impossible to overestimate in the PC business. Ask any product manager who's tried to overturn an established PC product with a newer one: Even if the new product is demonstrably better than the old one, lots of users just won't change. (A computer-industry joke: How was God able to create the world in six days? He didn't have an installed base to deal with.)

That resistance to change shouldn't be so surprising. Those of us who find PCs innately interesting and challenging too often forget that most PC users fall into a different category. They don't want a graphing program; they want *graphs*. Give them a way to get graphs—let them work their way up the learn-

ing curve; let them build up a file of old graphs they can keep reusing and also adapt as templates for new work; let them get comfortable with a graphing package—and you're going to have a hell of a time getting them to switch.

Second, the leading non-Windows graphing packages are darned good programs. It's not like the early days of the business, when dumping something like Business & Professional Software's *Business Graphs* for, say, *Graphwriter* as a source of relief. No matter how sexy the *Persuasions* and *Charismas* are, you can get dazzling graphs out of *Harvard Graphics* and *Freelance Plus*.

Third, in times when PC acquisition and support budgets are being cut, and the dark clouds of an economic slowdown are on the horizon, corporations are thinking twice about moving their users to new software packages. The old "good enough" rule is at work here: Packages such as *Harvard Graphics*, *Freelance Plus*, and *Applause* are certainly good enough to turn out effective PC graphics. Is the gain in terms of net contribution to the bottom line so great as to justify moving to a package like *PowerPoint*?

Fourth and finally, while the move to Win-



dows has been dramatic, and has gotten a lot of press, the great majority of business users of PCs still live in a DOS world. That's not going to change anytime soon.

If you're moving to Windows, or already have made the move, by all means get a proper Windows-based graphing package. But if you haven't switched to a graphical operating environment, and you simply want to turn out charts and graphs for boardroom presenta-

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Jim Seymour

tions, none of the new packages provide a compelling reason for making the big switch.

REASONS FOR WAITING

One of the silliest bum raps the market-leading DOS graphing packages get is that it's impossible to create effective graphics outside a GUI interface. Remember:

These aren't character-based programs, like *WordPerfect* or *Lotus 1-2-3*, Release 2.x. Over the years, their developers have painstakingly crafted within DOS very effective, if idiosyncratic and proprietary, graphical approaches to showing you on-screen what you're going to get on paper, overhead transparencies, or slides.

By bridging that gap between character-based data input and graphical representations of the resulting output, programs such as *Harvard* and *Freelance* let many people work the way they prefer: first filling in a form, then flipping to a graphical view of the results.

And remember that among the *Windows* graphing packages, only *Pixie* lets you work in a truly graphical style. *Pixie* lets you drag charts' bars to make them taller or wider, pry open wedges in pie charts, and generally work directly with the finished graphic to produce the effect you want. The other programs, despite their *Windows* interfaces, still involve building little tables of data, then previewing how that will appear in print.

Yet *Pixie* is hardly burning up the best-seller lists.

I don't want to sound like a Luddite on this. *Persuasion* is one of the most useful new programs I've used this year. I love the freedom it gives me to rearrange images in sequences, and to play with fonts and graduated backgrounds. And such features as *Persuasion's* AutoTemplates are clearly important, because they help bring consistency to business presentations. Used correctly, those templates can also speed up the production of graphs.

But as much as I like working with these new *Windows* entries, and as important as I think they're going to be to the future of PC graphics, I don't fool myself about the near-to-mid-term future of established charting and graphing packages.

They're not going away anytime soon. Because most PC graphics users want *graphs*, not new toys. ■

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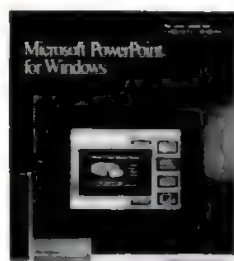
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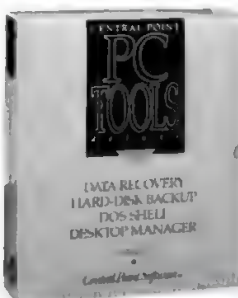
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William F. Zachmann



1991 Predictions

Here once again, our intrepid columnist ventures his 13 predictions for the year ahead.

Well, it's time to brush off the old crystal ball again! Let's see what it's got to say for 1991:

Prediction 1: Clear Limits to Windows' Momentum. *Microsoft Windows 3.0* has tremendous momentum as 1990 ends. It's topped the software best-seller lists, sales of *Windows* applications are picking up steam, some pundits are proclaiming OS/2 "dead," and major market research firms project *Windows* to dominate the decade ahead.

Windows will continue to do well in 1991. It will *not*, however, be the invincible juggernaut that its more-wild-eyed enthusiasts claim. Plenty of desktops will remain character-mode

DOS desktops. DOS extenders will continue to claim modest, though significant, market share. Some users will want

more-capable operating environments and move on to OS/2 or Unix.

The limits to *Windows 3.0*'s momentum will be clear by the end of 1991.

Prediction 2: OS/2 Alive and Well. The year ahead will put to rest premature rumors of OS/2's "death." The roll-out of OS/2 2.0 will demonstrate that OS/2 is alive and well, ensured by IBM and Microsoft's continued commitment to the operating system.

A significant number of desktops running *Windows 3.0* in 386 enhanced mode will switch to OS/2 once 2.0 is first released. Even more will do so as soon as Microsoft keeps its promise to support *Win 3* binaries under OS/2.

The result will be steady gains for OS/2 during 1991. Penetration of the installed base, though still modest (perhaps 8 percent), will nevertheless be much higher by year's end.

Prediction 3: A Better Year for Unix on the Desktop. Unix will also make headway in 1991 on desktops previously running DOS. Low-cost Unix-compatible systems like *Coherent*, new DOS/Unix hybrid options like *DESQview/X*, the expanded Intel architecture binary standard paving the way for "shrink wrap" Unix applications, a growing appetite for a 32-bit multitasking desktop environment, and continued pressure from workstations add up

to modestly improved prospects for Unix.

Prediction 4: Windows and OS/2 Prove Complementary. Stimulated in part by the growing "threat" of Unix, *Windows* and OS/2 will be made truly complementary to one another by both Microsoft and IBM. *Windows* will not compete with OS/2 but become an option on top of OS/2. That, after all, is precisely what the promised ability to run *Windows* binaries on OS/2 amounts to in practice: "Windows for OS/2" as an optional capability of the OS/2 Presentation Manager.

Prediction 5: Downsizing Accelerates. The year will bring a major acceleration of downsizing: replacement of traditional mainframe and minicomputers with micro-based alternatives. Economic pressure on corporate earnings will combine with maturing micro technology to drive users to low-cost solutions based on PCs, LANs, network servers, and multiple microprocessor-based systems.

Prediction 6: Mainframe/Minicomputer Demand Plummets. Downsizing will cause a major fall in demand for traditional mainframe and minicomputer systems of an even greater magnitude than that which occurred in 1985. It will be the largest drop in traditional computer



ILLUSTRATION: SHANNON JEFFRIES

sales on a year-to-year basis ever—possibly as much as 8 percent. It will mark the end of the first (traditional) era of computer systems and the beginning of the second (micro-based).

Prediction 7: A Dreadful Year (Financially) for IBM. That, in turn, will lead to a dreadful year for IBM Corp. Coming, as it does, just as IBM is trying to move to the new System/390 mainframes, the outcome will be financial results that make IBM's so-so performance during the

William F. Zachmann

last half of the 1980s look like the good old days.

Prediction 8: Lotus Bounces Back. Lotus, on the other hand, will do significantly better by the end of 1991. Caught short by *Windows*, and too smugly confident for too long, Lotus's problems were

widely recognized as 1990 drew to a close. But don't count Lotus out too quickly.

The company has a lot of strength in its installed base. New products, a firm commitment to both *Windows* and *OS/2*, and a strong sense for renewed efforts on the part of Lotus's management are likely to pay off with a healthy rebound in '91.

Prediction 9: Better Times for Apple. Apple, too, should be headed for better times by the end of this year. Late '90 and

early '91 shape up as a difficult period for Apple. But even as problems mount, Apple is taking the tough steps necessary to regain momentum, trading off short-term profits for longer-term market strength.

Windows 3.0 sharpened the competitive challenge to Apple, but it has also served to remind users how good the Macintosh has been all along. It has stimulated Apple to be more competitive. Apple should fare well as a result.

Prediction 10: Handwriting Computers Go the Way of the Quill Pen. Despite recent hoopla about handwriting input to computers, its impact in 1991 won't be much greater than that of the quill pen. Handwritten communication with a computer is "deja vu all over again" for anybody who remembers the Hewlett-Packard touch screen. Like voice input, it sounds great in theory but flops in practice.

Prediction 11: The PS/1 Follows the PCjr Into Obscurity. Speaking of "deja vu all over again," another that won't succeed is IBM's "home" computer—the PCjr. . . . uh, I mean the PS/1. Based on the assumption that lots of people are willing to spend more for less computer in a failing economy, the PS/1 repeats the basic mistakes of the PCjr minus the funny keyboard.

Prediction 12: Server Sales Take Off. Last year brought lots of introductions to powerful new microprocessor-based servers but little in the way of sales. The new year will not only see more introductions but a substantial increase in server sales, as well. These more-powerful systems have a longer evaluation and acquisition cycle than PCs. But as evaluation cycles are completed, server purchases will climb steadily, even as traditional mainframe and minicomputer sales fall.

Prediction 13: Silver Linings in Dark Clouds. Finally, despite generally gloomy economic clouds and stormy weather, there will be lots of silver linings for hardware, software, and network vendors who provide users with ways to save money on microprocessor-based systems.

We're at the threshold of a new era of information systems, dominated by the technologies that fueled the personal computer revolution in the 1980s, but expanded to the enterprise-wide information systems of the 1990s.

This will create plenty of new opportunities even as the general economy staggers and traditional system vendors struggle to survive. There will be a rainbow after the storm and a pot of gold at the end of the rainbow. ■

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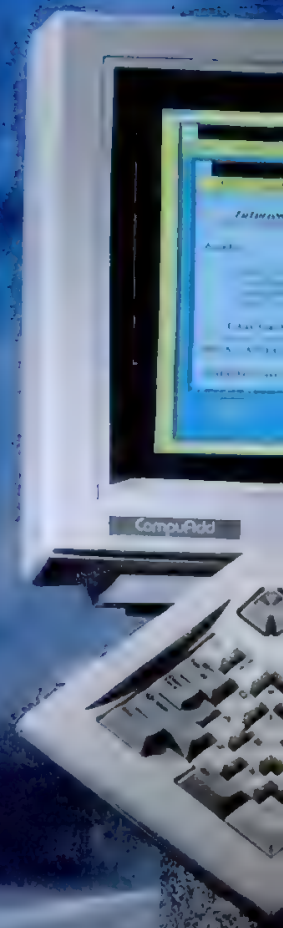
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*Winners and finalists—
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most innovative offerings in
the last year. We applaud
them, and pay our respects
to the people who
made it all happen.*

by Bill Machrone

The industry has come a long way in the seven years that *PC Magazine* has been presenting its Awards for Technical Excellence. People are taking bigger risks than ever before on new technologies in order to move the state of the art forward. As the installed base approaches 40 million, the obstacles to progress are great. Standardization can become stagnation. Products have to be truly outstanding to gain notice and to overcome people's natural resistance to change.

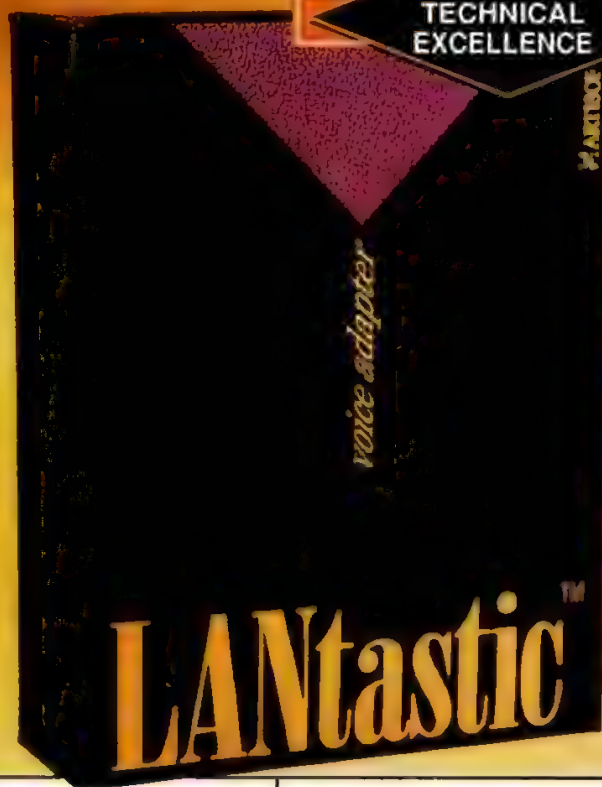
Our goal is to reward these new technologies and the people behind them. We hope to encourage their convictions, for their convictions are what make this a dynamic industry. Their deeply ingrained dissatisfaction with the status quo is the source of all progress, and their ability to dream is a constant challenge to us to understand the importance of their vision.

There's a lot of good news for users in this year's awards. File servers have eclipsed minicomputers in power and in the number of users they can support. Development environments have improved so that better, faster, and more robust programs can reach your desk more quickly than ever before. Laptop and notebook computers are challenging desktop machines. Stunning graphics that used to require tens of thousands of dollars of hardware are headed for your desktop VGA screen. Games are getting more educational, and education programs are getting more entertaining. And an exciting array of multimedia computers and products waits in the wings.

In the midst of these changes, one thing remains the same: the Awards for Technical Excellence go to the engineers and scientists, the programmers and developers, the *people* who make these products great. The commercial success of a product is never an issue. What is at issue are a product's technical merits—and our sense of how it advances the industry's lot and defines or harnesses the state of the art. To be eligible for the 1990 Awards for Technical Excellence, the candidate products had to ship between October, 1989 and October, 1990. We presented the Awards at Fall Comdex 1990, in Las Vegas.



COVER STORY
TECHNICAL
EXCELLENCE



CONNECTIVITY

1989 may officially have been "The Year of the LAN," but the trend continued right into 1990 with the introduction of truly excellent connectivity products like these. This year, the advantages of networked computing—across the office and across the country—became clearer than ever before.

WINNER

◆ **LANtastic Voice Adapter**

William J. Gleeson III, Alex Karahalios, Samuel J. McKelvie, C. John Schoof II

Artisoft Inc.
575 East River Rd.
Tucson, AZ 85704
(602) 293-6363

LANs have characteristically been silent partners in your daily computing chores. Artisoft's LANtastic Voice Adapter takes the best small-system network operating system into a new dimension by recording and playing back voice at the local workstation and sending it over the LAN. The \$149 Voice Adapter follows the usual Artisoft virtues of minimal RAM usage, high performance, and low cost. Voice mail is the basic application, but the system even allows real-time voice conversations over the LAN, so that it can be used as an intercom. Best of all, this is an open standard, with an inexpensive development kit available to developers who want to create low-cost multimedia applications. We've seen technology demonstrations of this sort before, but never at this low a price and high performance.

FINALISTS

Access/X.25

Shyam Prasad

Eicon Technology Corp.
2196 32nd Ave.
Montreal, Quebec, Canada H8T 3H7
(514) 631-2592

Connecting multiple LANs over a public network is no picnic. And X.25 isn't the most straightforward protocol. But Eicon Technology has tamed the myriad options and reduced them to a manageable collection of installation menus and batch files. No other X.25 product operates under both NetWare and NetBIOS protocols, giving Access/X.25 the widest possible market. With software for 32 virtual circuits, full gateway and terminal emulation, and a powerful coprocessor board, Access/X.25 bridges the enormous LAN-to-LAN gulf in a way that's a clear advance over earlier offerings.

LAN Manager, Version 2.0

Paul Canniff, Andy Heid, Brian Valentine

Microsoft Corp.
One Microsoft Way
Redmond, WA 98052
(206) 882-8080

In connectivity, architecture is everything. Microsoft has designed a network operating system that fully utilizes the powerful hardware offered by Compaq and other manufacturers. LAN Manager 2.0 has all the right underpinnings: OS/2 and Unix support, support for international and industry standards, and a healthy understanding of client-server architecture. Additionally, in networks of computers running OS/2, every machine can contribute resources to the network. LAN Manager is a top network operating system for today, but its real technical excellence is as a platform for growth in networks using distributed applications and distributed processing. LAN Manager is designed and prepared for tomorrow.

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Manufacturing Company, Inc.

CURTIS



DESIGN

Not since 1988, when the redesigned Microsoft Mouse walked off with the newly created Design award, has a group of products so captured our attention by the sheer elegance of their execution and their overall functionality.

WINNER

◆ Xircom Pocket LAN Adapter

Jerome Czerwinski, Dirk Gates, Kirk Mathews, Monte Pooley

Xircom Inc.
22231 Mulholland Hwy., #114
Woodland Hills, CA 91364
(818) 884-8755

As more and more users are being asked by their companies to choose between a portable or desktop machine, a LAN adapter for portables is a timely product indeed. What sets Xircom's solution apart from the rest is its shapely size. Unlike docking stations, which typically are overweight, oversized, and overpriced, the 5-ounce, 5-inch Pocket LAN Adapters (units are available for Ethernet, Token-Ring, and Arcnet networks) are models of space efficiency. They connect to the PC's parallel port and require no internal expansion slots. As portable computers get more capable, the need for the docking station diminishes. But the LAN adapter is always a matter of choice. Xircom delivers that choice in the smartest, most stylish manner imaginable.

FINALISTS

Ergo Brick

Jim Bleck (Bleck Design Group), Tom Spalding (Ergo Computing)

Ergo Computing Inc.
One Intercontinental Way
Peabody, MA 01960
(800) 633-1925

You might think of Ergo's Brick as the end of boring beige boxes. Available in a granite-finish case, the Brick (and its big brother, the Stretch Brick), set a new standard for compactness, smart design, and slick styling—all within industry standards. Moving the power supply outside the case makes for a cool-running, quiet machine. The 386SX-based Brick is equally comfortable in the office and at home; at 8.3 lbs., the CPU is easy to carry between the two. Its rugged, rubber-cushioned design invites you to pick it up and move it around. With Super VGA circuitry, built-in I/O ports, a 2,400-bit-per-second modem, and room for 8MB of RAM, the diminutive system sacrifices nothing in performance or expandability.

GRiDCASE 1550sx

Jim Cole, Steve Friend, Allen Lee, Adele Odegaard, Mark Schiebl

GRiD Systems Corp.
47211 Lakeview Blvd.
Fremont, CA 94538
(415) 656-4700

The GRiDCASE 1550sx continues the bold, functional styling that has always set GRiD computers apart. It is the first commercial implementation of the highly usable and Microsoft Mouse-compatible Isopoint, the first integral pointing device to be offered on a laptop. The 1550sx is designed top to bottom to be a graphics machine, from its sharp VGA backlit-LCD display to the smooth operation of the Isopoint in Windows applications.

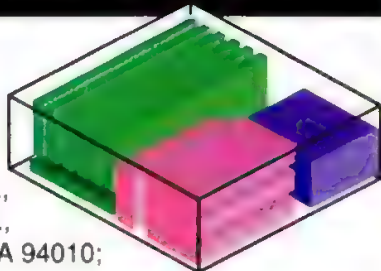
A Winner.

We didn't say it.
PC Magazine did.



FACT FILE

EDITORS' CHOICE



**Tangent
386SX/20**
Tangent
Computer, Inc.,
303 Beach Rd.,
Burlingame, CA 94010;
(800)223-6677,
(415) 342-9388.

List Price: With 1MB RAM, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, one parallel and two serial ports, VGA monitor, \$1,644; with 2MB RAM, 60MB hard disk, DOS 4.01, \$2,278; with 105MB hard disk, \$2,384.

In Short: An excellent contender with above-average electronics and hard-working peripherals, the Tangent 386SX/20 adds an FCC Class B certification to the pile to make it an extremely attractive computer for either home or office.

"The 20 MHz 80386SX is the new entry-level business system of choice, starting right now."

PC Magazine

Best choice of the best choices.

Here's how PC Magazine summed up the Tangent 386TMSX/20 (Tangent's Model 320s):

"The Tangent 386SX packs outstanding video, expandability to 8 MB, and plenty of free slots into a nicely reduced-size case. The price is right too. This PC offers a 105 MB hard disk and Orchid's ProDesigner II Super VGA card for a mere \$2295. Add in clear documentation and on-site service (with Tangent's one-year warranty) and you have a solid winner."

"The Tangent 386SX/20 is the best of the show; it garnered top scores in all of our video tests."

A system with a future. The Tangent 386SX/20 runs all of yesterday's programs. All of today's. And most important, tomorrow's. Because it implements the full Intel 80386 feature set.



Standard Configuration:

- Intel 20 MHz 80386SX CPU **\$2295**
- 2 MB of Memory (to 8 MB)
- 105MB 17ms Quantum Hard Disk
- Orchid ProDesigner II SuperVGA Card
- 14" SuperVGA Color Monitor
- Small Footprint Case w/200W Power Supply
- 5.25" or 3.5" High Density Floppy Drive
- Coprocessor Socket
- One Parallel, Two Serial, One Game Port
- 101-key Enhanced Keytronics Keyboard
- One-year Warranty with On-site Service



November 27, 1990
Tangent 320S

Why buy their computer, when we'll build yours?

High performance. Low price, Tangent offers you a complete line of high performance systems: 20 MHz 80386, 25 and 33 MHz 80386SD, and award winning 25 and 33 MHz 80486. All, at what some people think is the best price-to-performance ratio in the business.

Built your way. Dealing with Tangent is like owning your own computer factory. Tell us exactly how you want your system configured, we'll build it, test it, and ship it. Your way. And even though it's your configuration, it carries our one-year warranty.

PC Magazine's windup: "Add an FCC Class B rating and a one-year warranty on parts and labor that includes on-site service into the bargain, and you begin to suspect that the Tangent 386SX/20 is a winner. Consider the price/performance ratio of the computer and that suspicion starts to look like a certainty."

Bill O'Brien, PC Magazine, 11/27/90

Thanks Bill. We couldn't have said it better.

Order now, Toll Free:

1-800-223-6677



TANGENT
COMPUTER

197 Airport Blvd. Burlingame, CA 94010
Phone: 415/342-9388 FAX: 415/342-9380

CIRCLE 391 ON READER SERVICE CARD

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33-MHz, 80386, What Else Can



EISA... \$1995 We Say?



Introducing the ALR BusinessVEISA Model 101...

What else can we say about a deal that's this good? Well, maybe we could add that the ALR BusinessVEISA 386/33 Model 101 also lets you **"just upgrade the CPU™."** It's the only affordable upgrade path to 25- or 33-MHz i486™ processing, and beyond. And perhaps we should also mention that this system can accommodate up to 17-MB of memory right on the system board. And it probably wouldn't hurt to talk about the standard 1-MB of RAM, built-in IDE hard drive controller, optional cache module, standard 1.2-MB 5.25" floppy drive, standard serial and parallel ports, and ALR's limited one-year warranty.

But, quite honestly, none of those features are quite as impressive as this one. For just **\$1995**, you can purchase a **33-MHz 386™-based PC** with a **true 32-bit EISA bus** — to easily tackle today's power applications in business, desktop publishing, CAD/CAM, multiuser and networking. Who else makes a system that can match the BusinessVEISA 386/33 Model 101 in price, versatility, and performance? Nobody.



Call ALR today and we'll put you in touch with your closest ALR reseller:

ALR 1-800-444-4ALR

Advanced Logic Research, Inc. 9401 Jeronimo Irvine, CA 92718 (714) 581-6770
FAX: (714) 581-9240

ALR systems are available at these selected resellers:

**ALR Power Partner
Resellers**

Connecting Point 
COMPUTER CENTERS

ENTRE

TCBC

Prices and configurations subject to change without notice. Prices based on U.S. Dollars. Shown with optional monitor and mouse. ALR is a registered trademark and BusinessVEISA is a trademark of Advanced Logic Research, Inc. All other brand and product names are trademarks or registered trademarks of their respective owners. © 1990 by Advanced Logic Research, Inc. AST®, here's one more thing!

CIRCLE 151 ON READER SERVICE CARD



DEVELOPMENT TOOLS

It takes developers no small amount of time and effort to put together a smooth-running final product. No programs introduced this year are better equipped than these to help them make it all happen.

WINNER

◆ Turbo C++ Professional

Turbo C++ Development Team

Borland International Inc.
1800 Green Hills Rd.
Scotts Valley, CA 95066
(408) 438-8400

Borland's best just keeps getting better. *Turbo C++ Professional* is a full implementation of the C++ specification, the reigning standard in object-oriented programming. Of course, it incorporates Borland's VROOMM technology, which raises overlay management to a high art form, and the Programmer's Platform, an evolution of Borland's interactive edit/compile/link environment. It also includes Version 2.0 of 1988's Technical Excellence-winning *Turbo Debugger*, as well as *Turbo Assembler 2.0*, and the hot new *Turbo Profiler*, which shows you where your programs are spending the most time and helps you optimize them. This is the fastest, most complete development environment around, and it's hard to imagine how Borland will next improve upon it.

FINALISTS

Actor, Version 3.0

Jim Bolland, Scott Kerber, John Leahy,
Jim McCarthy, Mark Solinski

The Whitewater Group
1800 Ridge Ave.
Evanston, IL 60201
(708) 328-3800

Actor is the granddaddy of object-oriented development environments for the PC. The Whitewater Group pioneered this technology in *Windows 2.0* and has brought it to new heights under *Windows 3.0*. The included class and object libraries let the programmer get right to work without having to learn the complexities of *Windows'* calls. This very-high-level language distills pages of code down to a few lines. *Actor 3.0* includes automatic memory management and swapping so that programs as large as 2MB can run on 640K systems. *Actor* is a key tool for ushering in the next generation of graphical applications.

Clarion Professional Developer, Version 2.1

Bruce Barrington, John Herron,
Kim Kemp, Stephen Kemp

Clarion Software Corp.
150 East Sample Rd.
Pompano Beach, FL 33064
(800) 354-5444
(305) 785-4555

We've always liked *Clarion's* powerful, straightforward language, which has the readability of COBOL or BASIC and the structural integrity of Pascal. And it's more economical than any of these, getting more done in a line of code than virtually any other language. *Clarion Professional 2.1* goes beyond these basic strengths with a powerful new report writer and enhancements to the Designer module, a facility for designing, building, and testing applications. The advances in this latest version make *Clarion* a powerful weapon for creating standalone or LAN applications.

ToolBook, Version 1.0

Steve White and the Asymetrix Development Team

Asymetrix Corp.
110 110th Ave. NE, #717
Bellevue, WA 98004
(206) 462-0501

Development tools take many forms, and one of the most pleasant is *ToolBook 1.0*. After years of development, Asymetrix has made great strides in delivering user-friendly, object-oriented applications development to the *Windows* platform. *ToolBook's* language is easily learned, and users with rudimentary programming skills can put together simple, useful applications. Programmers with more skill can create complex graphical applications based on hyperdocuments or more traditional file structures. We're especially excited about *ToolBook's* extensibility and the role it will doubtless play in next year's multimedia PCs.

Primavera introduces some important new project management terminology.

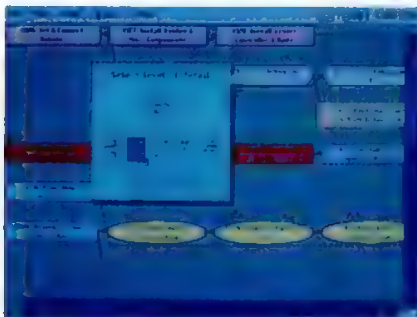
POP!

ZOOM!

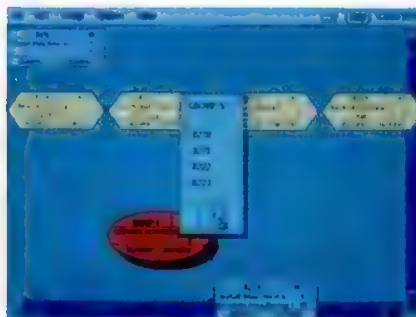
CLICK!

EXPLODE!

Click-Click—use double clicks to add activities, define relationships, and modify activity data.



Zoom — five levels of detail for your network, from bird's-eye to close-up.



Explode —The Collapse command compresses several activities into one; Explode redisplay activities in their original positions.



Pop — highlights all predecessor-successor relationships and lets you click your way along any activity path.

Primavera Project Planner® 4.0 works like you think. Visually. Graphically. Intuitively. As quickly as "pop", "click", "zoom"! Keeping you in touch with the big picture while giving you instant access to all the details.

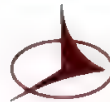
Create an activity? Point, click-click.
Define a relationship? Two clicks and done.
Updates? Double click and enter progress.

P3® 4.0 gives you copy, cut and paste, group and mark, and dozens of other powerful scheduling tools.

Plus, you can output the schedule to your plotter or laser printer with a few quick keystrokes. This is *what-you-see-is-what-you-get* schedule building. No sweat, no strain.

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PC _____

COVER STORY
TECHNICAL
EXCELLENCE

FINALISTS

Electrically Trainable Analog Neural Network (ETANN)

Kenneth Buckmann, Hernan Castro, Mark Holler, Leonid Koshevoy, Simon Tam

Intel Corp.
2250 Mission College Blvd.
Santa Clara, CA.
Mailstop SC9-40 95052-8125
(408) 765-9235

An Electrically Trainable Analog Neural Network (ETANN) chip may not be at the top of your shopping list, but Intel's new device is the cornerstone of an emerging class of products with far-ranging applications and implications. Neural networks can control mechanical devices with eerily human-like smoothness. They can decide whether an applicant gets a loan or not. They learn by observing the decisions that go into processes and then imitating them—not in a fixed, binary way, but with complex, brainlike interactions that weigh factors against one another. The designers talk of axons, neurons, and synapses because there are no better terms to describe the ETANN's inner workings. This is the smartest little 208-legged beast you're likely to encounter.

Thin-Film Transistor Displays

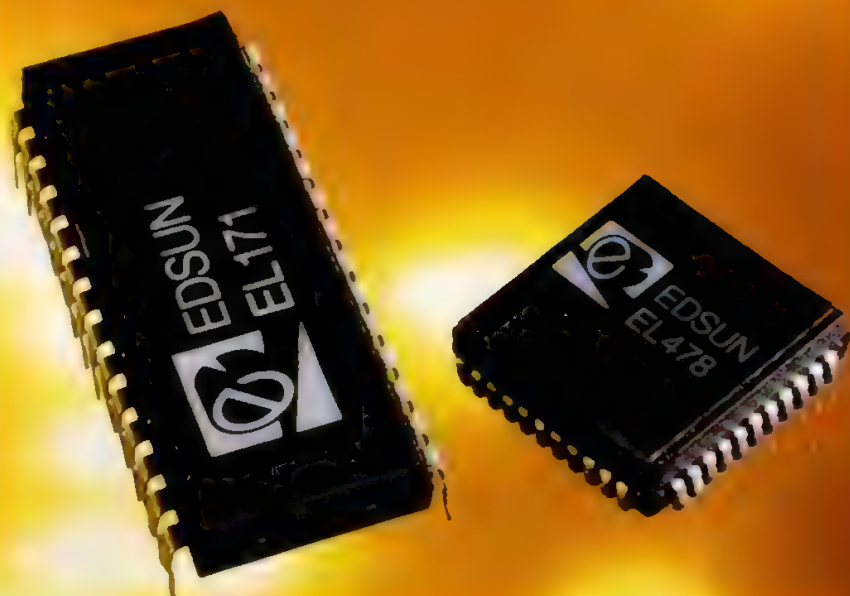
Dr. Mikio Ashikawa, Masauki Sato, Dr. Kenkichi Suzuki

Hitachi America Ltd.
300 North Martingale Rd., #600
Schaumburg, IL 60173
(708) 517-1144

The Sharp TFT Development Team

Sharp Electronics Corp.
Sharp Plaza
Mahwah, NJ 07430
(201) 529-8200

Imagine building a 50-square-inch device with a million perfect, transparent transistors on it. That's the challenge that Hitachi and Sharp have each taken on in building the world's first high-resolution LCDs. The results are breathtaking, with brilliant colors and a wide viewing angle that contradicts all our experience with flat-panel displays. Hitachi and Sharp are competitors, but however separate their efforts, they are dramatically changing the way we think about the shape, size, and capabilities of personal computers.



EMERGING TECHNOLOGY

The powers that be in the PC industry are continually working to advance the state of the art. The steps they are taking today may have far-reaching implications for tomorrow. This new Technical Excellence Award recognizes and applauds these technological strides. In other words, we have seen the future, and it is here.

WINNER

◆ **Edsun Continuous Edge Graphics**

Stewart Bailey, Larry Bodony, Steven Edelson, George Heron

Edsun Laboratories Inc.
564 Main St.
Waltham, MA 02154
(617) 647-9300

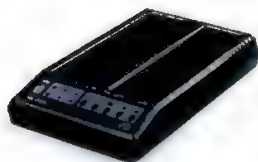
The VGA monitor has been woefully underused since its introduction more than three years ago. High prices were an obstacle to putting sufficient memory on the adapter, and bit depth slowed down screen processes to intolerable levels. Edsun offers a dramatic, inexpensive solution in the form of a chip that replaces the video digital-to-analog converter on a VGA card and increases the number of available colors from 256 to over 740,000. The CEG/DAC chip trades off a portion of palette for up to 32 brightness levels or color-mixture instructions for each of the colors displayed on the screen. The result is a strikingly realistic display achieved through anti-aliasing, the manipulating of pixels at the edges of objects. The images are far better than users had ever hoped to see on a PC, especially from a \$15 part.

PUT YOUR TRANSMISSION INTO



OVERDRIVE

9600etc/e



If you're a little old lady from Pasadena, you can probably pass on this baby.

But if you're into high

speed transmission and superior performance (at a price that's easy to handle), you're going to want to shift into the ATI 9600etc/e Modem.

Gear Up To 38,400 BPS

In a clutch or anytime, the 9600etc/e can perform at mind-boggling speeds. By combining the industry standard V.32 protocol with V.42bis data compression, the 9600etc/e can simultaneously transmit and receive data at over

38,400 bps... four times faster than other 9600 bps modems. Imagine the savings on transmission costs.

Easy Handling

Check out the dash. ATI's Easy-Set Front Panel gives you convenient access to frequently used commands. Whether you drive a PC or a mainframe, the 9600etc/e provides 100% error-free data transfer. Completely compatible with the Hayes* 'AT' command set, the 9600etc/e also supports MNP* protocols and slower modems operating at 2400, 1200 and 300 bps.

The ATI 9600etc/e. VROOOOOM.

For more information, contact your supplier or

ATI Technologies Inc.
3761 Victoria Park Avenue
Scarborough, Ontario
Canada M1W 3S2
Tel: (416) 756-0718
Fax: (416) 756-0720



ATI's Family of Products includes: 8514/ULTRA • VGA WONDER+ • 2400etc/e • 2400etc/i

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CIRCLE 337 ON READER SERVICE CARD

WINNER

◆ *Compton's MultiMedia Encyclopedia*

Jointly developed by Britannica Software Inc.,
Jostens Learning Corp., and The Delmar Group

Britannica Software Inc.
345 Fourth St.
San Francisco, CA 94107
(800) 533-0130

As the compact disc has changed the music world, the CD-ROM is beginning to change the publishing world. *Compton's MultiMedia Encyclopedia* is the first successful implementation of a product that combines words, pictures, and sound with an easy-to-use search engine. The product is incredibly adaptive to users' needs. You can browse a historical timeline, scan through pictures, click on diagrams to zoom in, and even watch animations. A glossary not only defines words but pronounces them. If you have any doubts about the viability of CD-ROM publishing, check out *Compton's*. It's utterly convincing. You can't help but be impressed by Britannica's courage and foresight in launching this product.

ENTERTAINMENT/ AFTER HOURS

It's not that cranking out worksheets and generating reports aren't critical tasks, but the PC is there for you to have fun with, too. Whether you want to test your hand/eye coordination, brush up on your musical skills or your knowledge of American history, or step into a simulation, these products are sure to engage.

FINALISTS

Band in a Box

Peter Gannon

PG Music
111-266 Elmwood Ave.
Buffalo, NY 14222
(416) 528-2368

This amazing little program from PG Music creates "music-minus-one" accompaniments for virtually any song, any style. You simply have to type in the chords, pick a tempo and one of 24 styles, and the program creates nicely embellished chords, a bass part, and drums to be played on a MIDI synthesizer. *Band in a Box* understands repeats, choruses, and verses, and even varies the accompaniment, just as human musicians would. Peter Gannon, the author of the program, makes no claims to artificial intelligence, but *Band in a Box* is software that repeatedly surprises and delights you, especially in its jazz styles.

Blockout

Dorota Blaszcak, Maciej Marjuszewski, Alexander Ustaszewski, Mirek Zablocki

California Dreams
130 Knowles Dr.
Los Gatos, CA 95030
(408) 378-0340

If you've mastered *Tetris*, it's time to move into three dimensions. California Dreams' fiendishly addictive *Blockout* is a 3-D brain-teaser of the first magnitude: In this game, you have to turn falling objects in space, then drop them into the right places in a pit. Every complete layer you form is worth points. The game is fast, fun, and configurable. Users can change the speed at which the block flips, and choose from nearly a thousand different combinations of pit sizes and block sets. We applaud the variety and extended life that such configurability offers. Simply put, *Blockout* is a knockout.

COVER STORY
TECHNICAL
EXCELLENCE

SimCity—The City Simulator

Will Wright

Maxis
Distributed by Broderbund Software
17 Paul Dr.
San Rafael, CA 94903-2101
(415) 492-3200

Is it a game or an occupation? A hobby or an education? No one really knows for sure, but *SimCity—The City Simulator* is easily the most diverting and absorbing pastime to come to the personal computer in the past year. The game lets you build towns and cities, zone them, populate them, build industrial centers, watch the pollution drive the people away, create traffic jams, wreak havoc from a menu of natural and unnatural disasters (including a Godzilla-like monster), impose taxes, and embezzle funds. You can build a park and watch property values increase. You can expand too quickly, go bankrupt, and watch that same neighborhood become a ghetto. The months and the years spin by, and the variations are seemingly endless. So is your enjoyment. *SimCity* is the culmination of four years of development on other platforms. We're thrilled to have it on the PC.

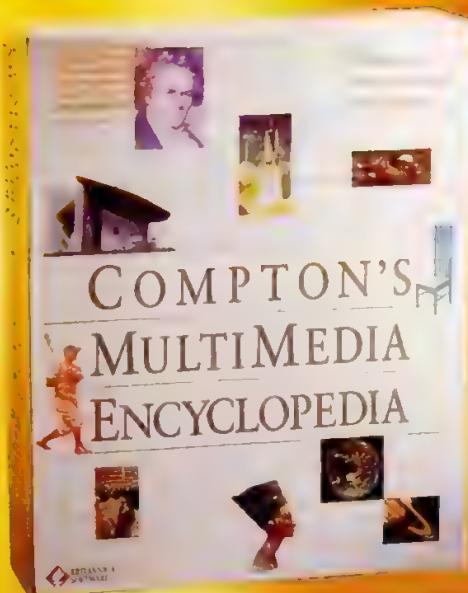
Where in the World is Carmen SanDiego? Deluxe Edition

Michelle Bushneff, Lance Groody,
Tom Rettig, Kim Walls

Broderbund Software
17 Paul Dr.
San Rafael, CA. 94903-2101
(415) 492-3200

One of the most popular and educational games just got better—and even more educational. The photorealistic VGA images in *Where in the World is Carmen SanDiego? Deluxe Edition* are from the National Geographic Society. Twice as many villains hide out in half again as many countries, and now there are over 2,500 clues with higher levels of diffi-

culty. Many more scenes are animated, and they're more convincing. The game now supports the MT-32, in addition to the AdLib and Sound Blaster boards. The music is much richer, and characters speak. The *Deluxe Edition* is a glimpse into the future of recreational software with an educational flair.



Compton's MultiMedia Encyclopedia is the first successful implementation of a product that combines words, pictures, and sound with an easy-to-use search engine. If you have any doubts about the viability of CD-ROM publishing, check out Compton's.



TANDON PROUDLY ANNOUNCES

We took our SL 386sx Slimline personal computer, upped its processing speed to 20 MHz. And managed to keep its price down. Under \$2,000. The result is the Tandon SL 386sx/20. A machine that offers a few ups and downs of its own.

For starters, processing speed is up, so processing time is down. Because we've combined INTEL® 80386SX power with full 32 bit internal processing, at a speed of 20 MHz.

And size is down. Because we've packed all this into a machine that stands only 5" tall.

But system integration is up. Because the Tandon SL 386sx/20 incorporates our proprietary MIAT™ (Mapper-Integrated AT) chip, for reduced chip count and increased reliability. Built-in communication ports

and mass storage controllers on the main board provide an even higher level of integration.

And expandability is up. With two serial ports and one parallel port. And 1MB of memory is standard; expandable to 5MB on board, with a 16MB maximum using an expansion card.

Of course, with any Tandon computer we provide you with a one year limited warranty. 24 hour technical support for life. On site service, if you ever need it. A 30 day no questions asked, full refund policy. Even a special leasing program.

So call Tandon today to find out more about the Tandon SL 386sx/20. Or for even more power, ask about our SL 486/25 for just \$3999. They both have their ups and downs in all the right places.

- 30-Day Money Back Guarantee
- Toll-Free Technical Support
- 1-Year Limited Warranty
- On-Site Service
- Leasing Program Available

Now \$1,999

ACES SOME UPS AND DOWNS.

Tandon SL 386sx/20 • Price includes system unit, 1MB RAM, 40MB IDE hard drive, 1.2 or 1.44MB diskette drive, VGA monochrome monitor, 16-bit video card, keyboard, power cord, operating and installation manual. • **Options:** 1MB and 2MB memory upgrade kits; Microsoft® Windows™ 3.0 and serial/bus mouse; additional 1.2MB and 1.44MB diskette drives; 110MB, 200MB IDE hard disk drive; VGA and Super VGA color monitors, 80387SX math coprocessor, 2400 baud modems, network cards, laser printers, Tandon MS-DOS software and manuals. **Tandon SL 486/25** • Price includes: system unit, 2MB RAM, 110MB IDE hard drive, 1.2 or 1.44MB diskette drive, VGA monochrome monitor, 16-bit video card, keyboard, power cord, Tandon MS-DOS software and manual, operating and installation manual, Microsoft® Windows™ 3.0 and serial mouse. • **Options:** 1MB and 2MB memory upgrade kits; additional 1.2MB and 1.44MB diskette drives; 200MB IDE hard disk drive; VGA and Super VGA color monitors, 2400 baud modems, network cards, laser printers. Additional options and features are available. **Call for details.**

OPTIONS AND CUSTOM CONFIGURATIONS

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|--|---|
| • Hard Drives, Diskette and Optical Drives | • VGA and Super VGA Monitors. |
| • Modems | • Additional Options Available On All Systems. Please Call. |
| • Memory Expansion | |
| • Coprocessors | |

Tandon

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CIRCLE 312 ON READER SERVICE CARD

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WINNER

◆ HP LaserJet III

Hewlett Packard's LaserJet III Design Team,
Boise Printer Division

Hewlett-Packard Co.
19310 Pruneridge Ave.
Cupertino, CA 95014
(800) 752-0900

The LaserJet III has one feature that sets it apart from every other 300-dot-per-inch printer—the Resolution Enhancement Technology chip. This HP-developed device is the last thing to look at your output before it's printed, and it looks at the edges. It looks for opportunities to smooth out jagged edges and ragged curves by substituting toner dots of different sizes. It doesn't care whether it's text or graphics; the output simply comes out markedly better. And how much does HP charge for this dramatic improvement? \$300 less than its predecessor, the LaserJet II. Once again, Hewlett-Packard has set the standard for all other laser printers.

HARDWARE

Across the board, this certainly has been a year for hardware advances. Add-in boards, input and output devices, and display technologies have all made rather significant leaps. Any of these peripherals or add-in cards can make your PC or portable do tricks you might not have thought possible at all...or at least, not possible for the price.

FINALISTS

DB Accelerator

Bob Lokken, Brad Surkamer, Ted Wimer, Albert Youngwerth

Extended Systems Inc.
6123 North Meeker Ave.
Boise, ID 83704
(208) 322-7575

Imagine a plug-in card that can make your dBASE applications run 100 times faster. You don't have to imagine it—it's here. The DB Accelerator is a combination of a RISC-based database coprocessor and SCSI hard disk controller. Together, they read .DBF files at speeds in the neighborhood of 10,000 records per second. Eminently suited to ad hoc queries, only the records meeting the search criteria are passed over the system bus to the requesting application. Accompanied by the *Query Processor*, a menu-driven query tool, and the *Datalens Driver* for *Lotus 1-2-3*, the DB Accelerator is a unique solution to problems shared by every heavy database user.

Epson ES-300C Image Scanner

Seiko Epson Corp.
The Terminal Printer Design Group

Epson America Inc.
20770 Madrona Ave.
Torrance, CA 90509-2842
(800) 289-3776 (dealer referral)

The Epson ES-300C looks like a fairly ordinary flatbed scanner. The brilliant difference is in this \$1,995 unit's scanning technology, where it uses three color tubes to illuminate the scanned document in one pass of the scanning head. It generates up to 24 bits of color depth (16.7 million colors) at 300-dot-per-inch resolution in the shortest amount of time we've ever seen. Among the bundled software are *HALOScan*, and Astral's *Picture Publisher Plus* for photo editing and retouching. The Epson's innovative design takes a new approach to the old problem

COVER STORY
TECHNICAL
EXCELLENCE

of scanning images with high accuracy and resolution, and that's what technical excellence is all about.

Private Eye

Allen Becker, Nathan L. Goldshlag, Ben Wells

Reflection Technology Inc.
240 Bear Hill Rd.
Waltham, MA 02154
(617) 890-5905

Not everybody needs what the Private Eye ultraminiature virtual display has to offer, but if you need it, there's no other place to get it. This unique 1.2- by 3.5- by 1.3-inch (HWD) display device, which can be built into a handheld device or mounted on a headset, projects a 12-inch 720 by 280 screen image in such a way that it appears to be floating in space a couple of feet in front of you. The vibrant red image is projected against a deep black background. Such a heads-up display is ideal for many industrial applications and may become the ultimate privacy option for using a personal computer in public places. This monochromatic 2.25 ounce version is the first product offering from Reflection Technology; future versions will include gray scale and, ultimately, full color.

TARGA+

Lisa Jones, Joe Shepard, Steve Spicklemire, Shawn Steiner, Bill Stoddard

TrueVision Inc.
7340 Shadeland Station
Indianapolis, IN 46256
(800) 858-8783
(317) 841-0332

It isn't possible to list all the features of the TARGA+ advanced video card here. It shouldn't be possible to fit all the features onto the board, either, but the designers did. TrueVision's TARGA+ replaces a whole line of older products and sets new standards in the process. It has VGA passthrough and overlay, chroma keying, video mixing, Advanced Genlock, a

Windows 3.0 driver, support for both interlaced and noninterlaced displays, broadcast-quality NTSC or PAL output, backward compatibility with its predecessors, and is one of the few high-end boards available for the PS/2 as well as ISA-bus machines. TARGA+ does more than any other high-end board we can think of, yet its price has dropped dramatically. Depending on the configuration, TARGA+ prices range from \$1,795 to \$2,995. TrueVision is a company that doesn't know how to rest on its laurels.

Hewlett-Packard's latest laser once again sets the standard for all other laser printers. The HP LaserJet III is not only a dramatically improved output device, but it also sells for \$300 less than its predecessor, the HP LaserJet II.



Complete Systems... No U

Complete Systems Philosophy

MicroLab computers are renowned for their industry leading technology, performance and pricing.

We only sell complete systems. Monitors and hard disks are standard in every one.

Look closely. Some ads boast low cost "base" units primarily to attract your initial interest. Known as fly paper advertising, they serve only as a price starting point, often requiring a floppy disk or monitor to become a truly complete, functional system.

MicroLab customers are smart. They demand a bargain and a complete solution.

Plus they avoid sticky situations.

Custom System Configurations

Along the same lines, we realize that not every customer will want a fully loaded system. Least wise, not

the exact way we've configured it.

That's where our highly trained Systems Consultants come in.

Tell them you want a modem or tape back up installed off the bat and they'll lay out all your options.

Tell them you're a student on a budget and they'll help you configure a system that will economically suit your current needs while providing for future expansion.

Tell them you're really into CAD or Desktop Publishing and they'll drive home your many CPU, video, graphics controller and co-processor options.

Go ahead. Ask them. They especially love this part of their job.

Consistently Superior Quality

Each MicroLab system is hand assembled and put through a 72-hour battery of stringently administered

diagnostic tests. All to assure "bugs free" operation prior to shipment.

Your system is made in the U.S.A. and is shipped straight to you.

Fast. Direct. No middlemen.

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No old technology or off brand, low cost "box stuffers" used here.

That's a promise. And a commitment!

Attention to Detail

At MicroLab, we believe your system should look as good as it performs. So it's no wonder our customers applaud the unique, trendsetting two-tone styling of our system cabinetry.

MICROLAB™ 486/25



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- 101 Key Tactile Switch Keyboard
- MS DOS 3.3 or 4.01

MICROLAB™ 386 Cache/25 & 386 Cache/33



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- Hard/Floppy Disk Drive Controller
- 14" Super VGA 1024x768 Monitor
- 16 Bit VGA Adaptor with 512K
- 2 Serial, 1 Parallel & 1 Game Port
- 101 Key Tactile Switch Keyboard
- MS DOS 3.3 or 4.01

MICROLAB™ 386/25



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- 2MB RAM-expandable to 8 MB
- 1 2MB 5.25" Floppy Disk Drive
- 1 44MB 3.5" Floppy Disk Drive
- 80MB Hard Disk Drive
- High Speed 1:1 Interleave
- Hard/Floppy Disk Drive Controller
- 14" Super VGA 1024x768 Monitor
- 16 Bit VGA Adaptor with 512K
- 2 Serial, 1 Parallel & 1 Game Port
- 101 Key Tactile Switch Keyboard
- MS DOS 3.3 or 4.01

Complete Super VGA 160MB System \$5195

Video Options — Include Monitor & Video Card							
MICROLAB 486/25 Price Matrix	Mono- Chrome 12" 720x360	Mono- Flat 14" 720x360	CGA Color 14" 640x480	EGA Color 14" 640x480	VGA Color 14" 640x480	VGA Multi 14" 800x600	VGA Hi-Res 14" 1024x768
30MB 1:1 Interleave	\$3745	\$3795	\$3895	\$4045	\$4095	\$4145	\$4245
40MB 1:1 Interleave	\$3785	\$3845	\$3945	\$4095	\$4145	\$4195	\$4295
65MB 1:1 Interleave	\$3895	\$3945	\$4045	\$4195	\$4245	\$4295	\$4395
80MB 1:1 Interleave	\$4195	\$4245	\$4345	\$4495	\$4545	\$4595	\$4695
120MB 1:1 Interleave	\$4295	\$4345	\$4445	\$4595	\$4645	\$4695	\$4795
160MB 1:1 Interleave	\$4695	\$4745	\$4845	\$4995	\$5045	\$5095	\$5195
320MB 1:1 Interleave	\$6295	\$6345	\$6445	\$6595	\$6645	\$6695	\$6795

Makes a great LAN Server or Multi Tasking Workstation!

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Landmark: 114.1 - Norton: 38.8

Complete Super VGA 120MB System \$3245*

Video Options — Include Monitor & Video Card							
MICROLAB 386 Cache/25 Price Matrix	Mono- Chrome 12" 720x360	Mono- Flat 14" 720x360	CGA Color 14" 640x480	EGA Color 14" 640x480	VGA Color 14" 640x480	VGA Multi 14" 800x600	VGA Hi-Res 14" 1024x768
30MB 1:1 Interleave	\$2195	\$2245	\$2345	\$2495	\$2545	\$2595	\$2695
40MB 1:1 Interleave	\$2245	\$2295	\$2395	\$2545	\$2595	\$2645	\$2745
65MB 1:1 Interleave	\$2345	\$2395	\$2495	\$2645	\$2695	\$2745	\$2845
80MB 1:1 Interleave	\$2645	\$2695	\$2795	\$2945	\$2995	\$3045	\$3145
120MB 1:1 Interleave	\$2745	\$2795	\$2895	\$3045	\$3095	\$3145	\$3245
160MB 1:1 Interleave	\$3145	\$3195	\$3295	\$3445	\$3495	\$3545	\$3645
320MB 1:1 Interleave	\$3745	\$3795	\$3895	\$4045	\$4095	\$4145	\$4245

Makes an ideal CAD Workstation!

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Landmark: 40.5:53.5 Norton: 29.3:38.2

Complete Super VGA 80MB System \$2645

Video Options — Include Monitor & Video Card							
MICROLAB 386/25 Price Matrix	Mono- Chrome 12" 720x360	Mono- Flat 14" 720x360	CGA Color 14" 640x480	EGA Color 14" 640x480	VGA Color 14" 640x480	VGA Multi 14" 800x600	VGA Hi-Res 14" 1024x768
30MB 1:1 Interleave	\$1895	\$1945	\$1945	\$1995	\$2045	\$2095	\$2195
40MB 1:1 Interleave	\$1945	\$1995	\$1995	\$2045	\$2095	\$2145	\$2245
65MB 1:1 Interleave	\$1945	\$1995	\$1995	\$2045	\$2095	\$2145	\$2245
80MB 1:1 Interleave	\$2145	\$2195	\$2295	\$2445	\$2495	\$2545	\$2645
120MB 1:1 Interleave	\$2245	\$2295	\$2395	\$2545	\$2595	\$2645	\$2745
160MB 1:1 Interleave	\$2645	\$2695	\$2795	\$2945	\$2995	\$3045	\$3145
320MB 1:1 Interleave	\$3245	\$3295	\$3395	\$3545	\$3595	\$3645	\$3745

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MicroLab is a wholly owned subsidiary of the National Microcomputer Research Institute, an organization dedicated to the advancement of microcomputer technology.

We've evolved into a preferred vendor for government, educational and corporate institutions alike.

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Whether you've got your eye on a pre-configured MicroLab system or need assistance configuring one, call us today.

The call's on us!

MICROLAB™ 386/SX-16 & 386/SX-20

MICROLAB™ 286/12

MICROLAB™ XT/12



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- Hard Floppy Disk Drive Controller
- 14" Super VGA 1024x768 Monitor
- 16 Bit VGA Adaptor with 512K
- 2 Serial, 1 Parallel & 1 Game Port
- 101 Key Tactile Switch Keyboard
- MS DOS 3.3 or 4.01



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- 1 44MB 3.5" Floppy Disk Drive
- 30MB Hard Disk Drive
- High Speed 1.1 Interleave
- Hard Floppy Disk Drive Controller
- Hi Res Monochrome Monitor
- Monochrome Video Adaptor
- 2 Serial, 1 Parallel, & 1 Game Port
- 101 Key Tactile Switch Keyboard
- MS DOS 3.3 or 4.01



MS Next Day Service Available!

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- 30MB Hard Disk Drive
- Hard Floppy Disk Drive
- Hi Res Monochrome Monitor
- Monochrome Video Adaptor
- Serial, Parallel & Game Ports
- 101 Key Tactile Switch Keyboard
- MS DOS 3.3 or 4.01

Complete Super VGA 65MB System \$1995*

Video Options — Include Monitor & Video Card							
MICROLAB 386 SX-16	Monochrome 12"	Monochrome 14"	CGA Color 14"	EGA Color 14"	VGA Color 14"	VGA Multi 14"	VGA Hi-Res 14"
Price Matrix	729.350	729.350	640.200	640.350	640.400	690.400	1024.700
30MB 1.1 Interleave	\$1345	\$1395	\$1695	\$1645	\$1695	\$1745	\$1845
40MB 1.1 Interleave	\$1395	\$1445	\$1745	\$1695	\$1745	\$1795	\$1895
65MB 1.1 Interleave	\$1495	\$1545	\$1845	\$1795	\$1845	\$1895	\$1995
80MB 1.1 Interleave	\$1595	\$1645	\$1945	\$1895	\$1945	\$1995	\$2095
120MB 1.1 Interleave	\$1695	\$1745	\$2045	\$1995	\$2045	\$2095	\$2195
160MB 1.1 Interleave	\$1795	\$1845	\$2145	\$2095	\$2145	\$2195	\$2295
229MB 1.1 Interleave	\$1895	\$1945	\$2245	\$2195	\$2245	\$2295	\$2395

386 Performance with 286 Compatibility

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Landmark: 21/25.4 Norton: 17.6/22.0

Complete Monochrome 30MB System \$995

Video Options — Include Monitor & Video Card							
MICROLAB 286 12	Monochrome 12"	Monochrome 14"	CGA Color 14"	EGA Color 14"	VGA Color 14"	VGA Multi 14"	VGA Hi-Res 14"
Price Matrix	729.350	729.350	640.200	640.350	640.400	690.400	1024.700
30MB 1.1 Interleave	\$895	\$1045	\$1145	\$1295	\$1345	\$1395	\$1495
40MB 1.1 Interleave	\$1045	\$1195	\$1295	\$1445	\$1495	\$1545	\$1645
60MB 1.1 Interleave	\$1145	\$1295	\$1395	\$1545	\$1595	\$1645	\$1745
80MB 1.1 Interleave	\$1245	\$1395	\$1495	\$1645	\$1695	\$1745	\$1845
120MB 1.1 Interleave	\$1345	\$1495	\$1595	\$1745	\$1795	\$1845	\$1945
160MB 1.1 Interleave	\$1445	\$1595	\$1695	\$1845	\$1895	\$1945	\$2045
329MB 1.1 Interleave	\$1545	\$1695	\$1795	\$1945	\$1995	\$2045	\$2145

Makes an ideal small business system

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Landmark: 16.1 - Norton: 13.4

Complete Monochrome 30MB System \$745

Video Options — Include Monitor & Video Card							
MICROLAB XT 12	Monochrome 12"	Monochrome 14"	CGA Color 14"	EGA Color 14"	VGA Color 14"	VGA Multi 14"	VGA Hi-Res 14"
Price Matrix	729.350	729.350	640.200	640.350	640.400	690.400	1024.700
30MB 1.1 Hard Disk	\$745	\$795	\$895	\$1045	\$1095	\$1145	\$1245
40MB 1.1 Hard Disk	\$795	\$845	\$945	\$1095	\$1145	\$1195	\$1295
60MB 1.1 Hard Disk	\$845	\$895	\$995	\$1145	\$1195	\$1245	\$1345
80MB 1.1 Hard Disk	\$895	\$945	\$1045	\$1195	\$1245	\$1295	\$1395
120MB 1.1 Hard Disk	\$945	\$995	\$1095	\$1245	\$1295	\$1345	\$1445
160MB 1.1 Hard Disk	\$995	\$1045	\$1145	\$1295	\$1345	\$1395	\$1495
329MB 1.1 Hard Disk	\$1045	\$1095	\$1195	\$1345	\$1395	\$1445	\$1545

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Landmark Speed Test: 13.4

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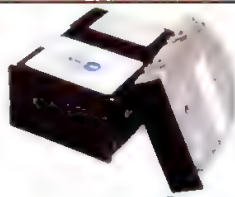
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Hard Disk MicroKits



AT Kit

Seagate ST225 20MB, 65ms, MFM, HH	178 183 223
Seagate ST238R 30MB, 65ms, RLL, HH	195 200 243
Seagate ST250R 40MB, 68ms, RLL, HH	199 204 249
Seagate ST251-I 40MB, 28ms, MFM, HH	269 274 315
Seagate ST277R-1 65MB, 28ms, RLL, HH	299 304 339
Seagate ST296N 80MB, 28ms, SCSI, HH	399 404 449
Seagate ST4096 80MB, 28ms, MFM, FH	517 522 557
Seagate ST4144R 120MB, 28ms, RLL, FH	569 574 609
Seagate/Imprimis ST4182E 160MB, 17ms, ESDI, FH	949 INQUIRE
Seagate/Imprimis ST4182N 155MB, 17ms, SCSI, FH	979 INQUIRE
Seagate/Imprimis ST4350N 307MB, 18ms, SCSI, FH	1399 INQUIRE
Seagate/Imprimis ST4384E 329MB, 15ms, ESDI, FH	1599 INQUIRE
Seagate/Imprimis ST2383E 337MB, 16ms, ESDI, HH	1599 INQUIRE
Seagate/Imprimis ST2383N 338MB, 16ms, SCSI, HH	1629 INQUIRE
Seagate/Imprimis ST4766E 676MB, 16ms, ESDI, FH	2099 INQUIRE
Seagate/Imprimis ST4766N 676MB, 16ms, SCSI, FH	2149 INQUIRE
Seagate/Imprimis ST41200N 1050MB, 17ms, SCSI, FH	3899 INQUIRE

K/Lok KL320 20MB, 40ms, MFM, HH	169 174 215
K/Lok KL330 30MB, 40ms, RLL, HH	179 184 229
Seagate ST138R 30MB, 40ms, RLL, HH	249 254 295
Seagate ST157R 50MB, 40ms, RLL, HH	275 279 319
Seagate/Imprimis ST1100 88MB, 15ms, MFM, HH	649 654 697
Seagate/Imprimis ST1162N 142MB, 15ms, SCSI, HH	779 INQUIRE
Seagate/Imprimis ST1201E 177MB, 15ms, ESDI, HH	1029 INQUIRE
Seagate/Imprimis ST1201N 177MB, 15ms, SCSI, HH	1049 INQUIRE

MicroLab MicroKits Include:

- Hard Disk Drive
- Disk Manager Software for Drives 40MB and Up for XT Kits
- Mounting Hardware
- Bezel & Cabling
- Comprehensive Installation Manual

MicroLab Hard Cards



Hard Card

Hard Card/20 20MB, 40ms	245 265 339 359
Hard Card/30 30MB, 40ms	269 289 359 375
Hard Card/50 50MB, 40ms	349 369 439 539
Hard Card/90 88MB, 15ms	699 719 N/A 829

MicroLab Hard Cards are complete "plug 'n play" high performance hard disk sub-systems. The hard disk and controller card are mounted in-line on a slimline chassis. Mounted in any open bus expansion slot, the unit saves valuable drive bay space for other peripheral devices while minimizing overall system power consumption. 5 minute installation!

Floppy Disk Drives

TOSHIBA



MITSUMI

360KB Floppy 5.25", Black or Beige Bezel	54
720KB Floppy 3.50", Black or Beige Bezel	59
1.2MB Floppy 5.25", Beige Bezel	68
1.44MB Floppy 3.50", Black or Beige Bezel	69

Hard Disk Controllers

WESTERN DIGITAL CORPORATION



Western Digital XTGEN2PLUS Dual Hard Disk Controller, 8-Bit, 3:1 Int	45
Western Digital 1003VMM2 Hard/Floppy Disk Combination, 16-Bit, 2:1 Int	76
Seagate ST22-M Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	79
Western Digital 1006VMM2 Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	89

Western Digital 1004-A27X Dual Hard Disk Controller, 8-Bit, 3:1 Int	45
Seagate ST11-R Dual Hard Disk Controller, 8-Bit, 3:1 Int	48
Western Digital 1003VSR2 Hard/Floppy Disk Combination, 16-Bit, 2:1 Int	86
Seagate ST22-R Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	89
Western Digital 1006VSR2 Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	99

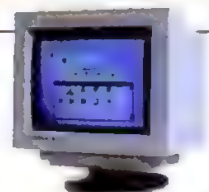
Seagate ST-01 Dual Hard Disk Controller, 8-Bit, 3:1 Int	39
Seagate ST-02 Hard/Floppy Disk Combination, 8-Bit, 3:1 Int	45
Western Digital 7000FASST Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	299

Western Digital 1007VSE1 Dual Hard Disk Controller, 16-Bit, 1:1 Int	155
Western Digital 1007VSE2 Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	159

Monitors



AOC
NEC



TTL Monochrome 12", Amber, 720x350, tilt/swivel base	65
Amber Flat Screen 14", Amber, 720x350, tilt/swivel base	97
Page White Flat Screen 14", Page White, 720x350, tilt/swivel base	99
VGA Monochrome 14", Page White, 656x496, tilt/swivel base	119
CGA Color 14", 640x240, tilt/swivel base	189
EGA Color 14", 640x350, tilt/swivel base	275
VGA Color 14", 720x400, tilt/swivel base	299
VGA Multi-Scanning Color 14", 800x600, tilt/swivel base	369
Super Hi-Res VGA 14", 1024x768, tilt/swivel base	399
NEC 3D Super Hi-Res VGA 14", 1024x768, tilt/swivel base	599

Video Graphic Boards

MaxLogic



ML/MGP Monochrome graphic with printer port	25
ML/CGP Color graphic with printer port	28
MaxLogic Auto EGA EGA autoswitch, 256K RAM, 800x600	79
Great Tek VGA VGA, 16Bit, 256KB/512Exp. RAM, 1024x768	109
ATI VGA Wonder/256 VGA, 16Bit, 256KB RAM, 1024x768, OEM	179
ATI VGA Wonder/512 VGA, 16Bit, 512KB RAM, 1024x768, OEM	199



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Printers

Panasonic



Panasonic 1180	159
192cps, 80 col., 9-pin	
Panasonic 1191	219
240cps, 80 col., 9-pin	
Panasonic 1124	279
192cps, 80 col., 24 pin	
Panasonic 1624	349
192cps, 132 col., 24 pin	
Panasonic 4420	899
Laser, 8pp per minute, 22 fonts	
Panasonic 4450i	1299
Laser, 11pp. per minute, 28 fonts	
Panasonic 4455 PostScript	CALL
Laser, 11pp. per minute, 39 fonts	
Star NX1000II	159
144cps, 80 col., 9-pin	
Star NX1000 Rainbow	199
144cps, 80 col., 9-pin	
Star NX1500	279
192cps, 132 col., 9-pin	
Star XR1000	299
300cps, 80 col., 9-pin	
Star XR1500	409
300cps, 132 col., 9-pin	
Star XB2410	429
240cps, 80 col., 24-pin	
Star XB2415	549
240cps, 132 col., 24-pin	

Modems

CARDINAL

HYUNDAI

STAR



1200 Internal	
1200/300 Baud Internal	47
2400 Internal	
2400/1200 Baud Internal	75
2400 External	
2400/1200 Baud External	89

All modems are Hayes compatible and come complete with user documentation. Internal models include terminal software

Tape Back-Ups

COLORADO



Colorado 60	
60.40MB Internal, half height	245
Colorado 500	
500MB Internal, half height, w/host adapter	989

Tape Back-Ups come complete with data compression and back-up software. PS/2 Kit Add \$69
External Kits Add \$125. Tape Adapter Cards Add \$69

Chips & Co-Processors

Intel



Intel 8087-3	87
5Mhz for XT systems	
Intel 8087-2	119
8Mhz for XT systems	
Intel 8087-1	149
10Mhz for XT systems	
Intel 80287-6	119
6Mhz for 286 systems	
Intel 80287-8	187
8Mhz for 286 systems	
Intel 80287-10	209
10Mhz for 286 systems	
Intel 80387-SX	279
SX for 386 systems	
Intel 80387-16	299
16Mhz for 386 systems	
Intel 80387-20	349
20Mhz for 386 systems	
Intel 80387-25	445
25Mhz for 386 systems	
Intel 80387-33	549
33Mhz for 386 systems	

*Ask for current DRAM, SIPP & SIMM pricing!

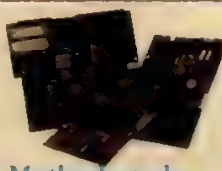
Mice & Software

Genius



Genius GM-6X	20
3 Button, 200-800 DPI w/Dr. Halo	
Genius GM-6000	35
3 Button, 350-1050 DPI w/Dr. Halo	
Genius GM-F302	47
3 Button, 350-1050 DPI w/Dr. Genius	
Genius GeniScan	159
400 DPI, Bus Card w/Dr. Genius	

System Componentry



Motherboards

ML XT-12	59
4.77-12Mhz, Turbo Motherboard w/CPU	
ML 286-12	129
12Mhz, 4MB EMS Motherboard w/CPU	
ML 386-16SX	329
16Mhz, Neat-SX Motherboard w/CPU	
ML 386-20SX	499
20Mhz, Neat SX Motherboard w/CPU	

ML 386-25	639
25Mhz Motherboard w/CPU	
ML 386-25 Cache	799
25Mhz, 64KB Cache Motherboard w/CPU	
ML 386-33Cache	999
33Mhz, 64KB Cache Motherboard w/CPU	
ML 486-25	2499
25Mhz, Cache Motherboard w/CPU	

All MicroLab Motherboards come with comprehensive user documentation and set-up utilities.

System Componentry



System Cabinetry

ML-XT Case & Power Supply	
XT Slide, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 150W Power Supply	69
ML-Baby AT Case & Power Supply	
Baby AT, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply	89
ML-PS/2 Case & Power Supply	
PS/2, Slim Workstation, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply	95
ML-Mini Upright Case & Power Supply	
Mini Tower, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply	99
ML-Full Upright Case & Power Supply	
Full Tower, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 230W Power Supply	175

MicroLab system cases are ergonomically styled, two-tone units and come complete with speaker, generous expansion parts supply and 4-lead power supplies.

FOCUS



Keyboards

Focus FK-2001	
101 Key, true tactile "click" response, mechanical Alps switch, hinged dust cover/copy holder	49
Focus FK-3001	
111 Key, true tactile "click" response, mechanical Alps switch, built-in solar-powered calculator	59
Focus FK-5001	
130-Key, true tactile "click" response, mechanical Alps switch, built in battery operated calculator, both top and left side 12 key function key layouts, keyboard templates and holder, turbo switch	79

Add-On Cards

FDC-2	
Dual Floppy Disk Controller	15
AT I/O	
Parallel, Serial & Game Ports	19
XT Multi I/O	
Dual Floppy Disk Controller, Clock Calendar, Parallel, Serial & Game Ports	29
FDC-2 Multi	
Two FDC (360/1.2/720/1.44)	29
FDC-4 Multi	
Four FDC (360/1.2/720/1.44) Combo	39
XT High Density Multi I/O	
Dual Floppy Disk Controller, Clock Calendar, Parallel, Serial & Game Ports	59

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COVER STORY
TECHNICAL
EXCELLENCE

HP NewWave 3.0
for Windows

OPERATING ENVIRONMENTS

Operating environments are the focus of debate because they are at the heart of how we compute. No matter what your preference, though, you must admit these entries advance our conception of what computing can be.

WINNER

◆ HP NewWave, Version 3.0

The HP NewWave Team
Hewlett-Packard Co.
19310 Pruneridge Ave.
Cupertino, CA 95014
(800) 752-0900

HP NewWave turns Windows 3.0 into a flexible, helpful environment where complex tasks can be automated. By making Windows fully object oriented, it manages compound documents and becomes more network-aware. Object management starts with icons and launching programs and continues down into text, numeric, and graphical data types. Task management through Agents is fully implemented, and many vendors are producing NewWave-aware versions of their applications. The Bridges feature lets you work with old applications while managing the environment with NewWave. Benefits can be found in many areas, from ease of use to network management to the joining of applications in a way not possible in any other environment.

FINALISTS

DR DOS, Version 5.0

Steve Tucker
Digital Research Inc.
70 Garden Ct., Box DRI
Monterey, CA 93942
(408) 649-3896

Digital Research is the microcomputer operating system company that predates Microsoft. As if to prove it hasn't lost its touch, DR DOS 5.0 does all the things you wish MS-DOS did. Its features include a memory-management facility for moving the operating system, TSRs, and buffers and drivers into high memory; remote file-transfer capabilities; disk caching; battery-saving technology for laptops; support for disk partitions up to 512MB; and full compatibility with MS-DOS. Beyond that, it's ROM-able and has a simple yet powerful installation program and handy utilities, such as a full-screen editor, a cursor size and blink rate control command, and command line recall. The day of having 620K free to run programs is here, courtesy of Digital Research. Everybody's DOS should be this advanced.

GeoWorks Ensemble

PC GEOS Development Team

GeoWorks
2150 Shattuck Ave.
Berkeley, CA 94704
(415) 644-0883

Fast, tight code still has an important place, especially when it delivers a sophisticated and advanced graphical environment that's productive, easy to use, and works well on the millions of machines that don't have the horsepower to run Windows 3.0. The applications in *GeoWorks Ensemble* give document-oriented users everything they need to produce classy output on minimal equipment—without the additional expense for fonts or cartridges, and with the same metrics on the screen as on the printer. The underlying environment, *GEOS*, multitasks applications in real mode and provides an object-oriented, efficient environment for its small but powerful applications. *GeoWorks Ensemble* is a programming tour de force.

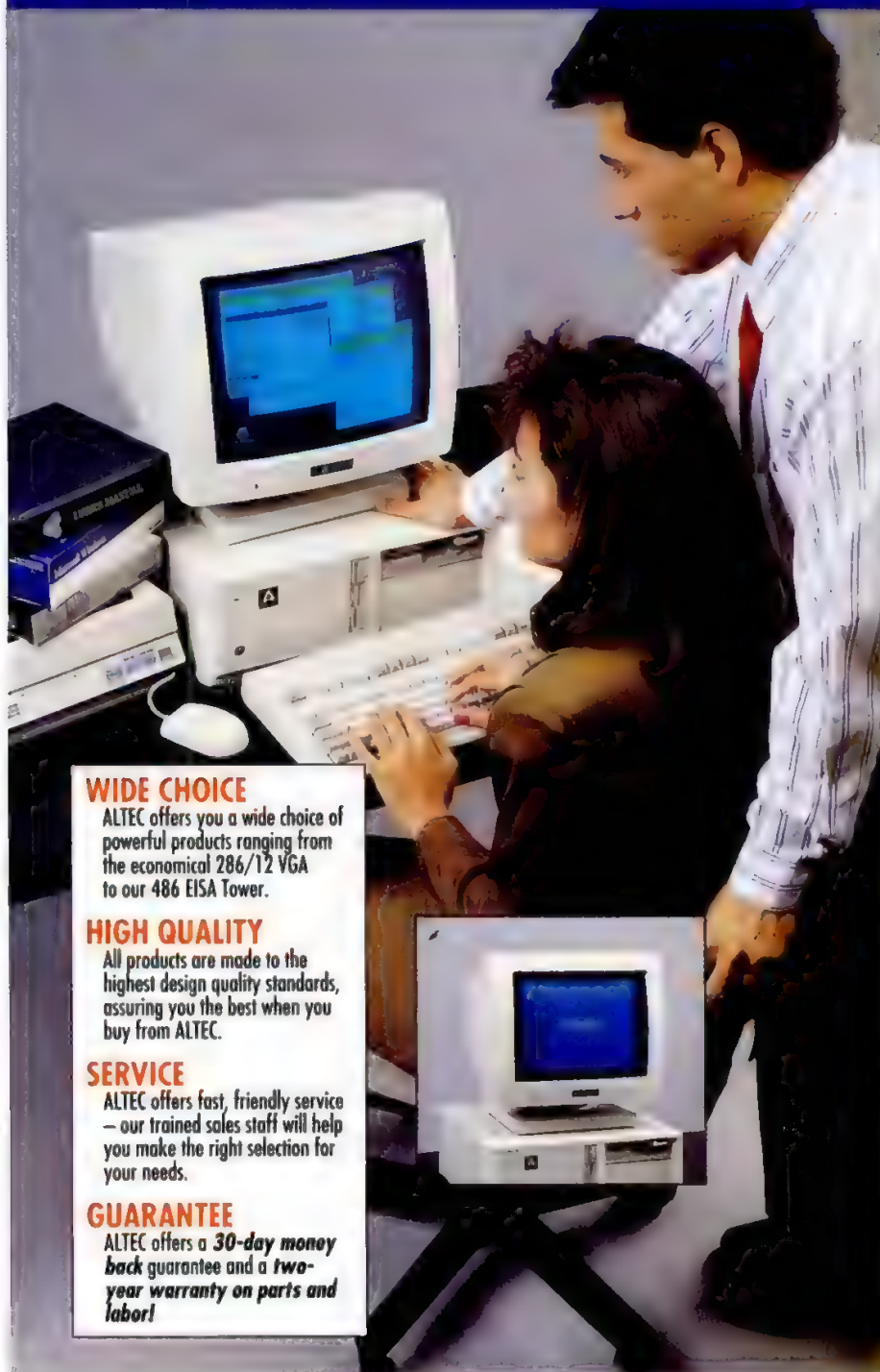
Microsoft Windows, Version 3.0

Phil Barrett, Jody Snodgrass, Russ Werner, and the Windows 3.0 Development Team

Microsoft Corp.
One Microsoft Way
Redmond, WA, 98052
(206) 882-8080

The goal of multitasking graphical applications and old DOS applications has been elusive, to say the least. Windows 3.0 finally does it, though, and with style. It features a terrific setup program, and it maximizes the use and performance of your hardware. Although it can run on a 286, Win 3 was born to run on a 386—with as many megabytes as you can spare. With the memory barrier finally and irrevocably broken, hundreds of developers have gotten on the Windows bandwagon. For some, Windows 3.0 and its successors will be all they ever need in an operating environment. For others, it sets the stage for even more-advanced 32-bit operating systems. Whatever the case, Win 3 has fundamentally changed the way people think about desktop computing.

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64K Cache • 4 Meg RAM • 1 2 MG 5 25" drive • 1 44 MB 3 5" drive • 104 MB IDE hard drive • 16 bit VGA card • 14" VGA monitor (1024 x 768) • 2 serial, 1 parallel & 1 game ports • 101-key Keyboard • Microsoft Window 3.0 • Hi-Res serial Mouse • MS-DOS 3.3 or 4.01

386/25 VGA **\$2,595**

4 Meg RAM • 1 2 MB 5 25" drive • 1 44 MB 3 5" drive • 104 MB IDE hard drive • 16-bit VGA card • 14" VGA monitor (1024 x 768) • 2 serial, 1 parallel & 1 game ports • 101-key Keyboard • Microsoft Window 3.0 • Hi-Res serial Mouse • MS-DOS 3.3 or 4.01

386/SX VGA **\$1,895**

2 Meg RAM • 1 2 MB 5 25" drive • 1 44 MB 3 5" drive • 40 MB IDE hard drive • 16-bit VGA card • 14" VGA monitor (1024 x 768) • 2 serial, 1 parallel & 1 game ports • 101-key Keyboard • Microsoft Window 3.0 • Hi-Res serial Mouse • MS-DOS 3.3 or 4.01 • (20 Mhz version add \$150)

286/12 VGA COMBO **\$1,595**

1 Meg RAM • 1 2 MB 5 25" drive • 1 44 MB 3 5" drive • 40 MB IDE hard drive • 16-bit VGA card • 14" VGA monitor (640 x 480) • 2 serial, 1 parallel & 1 game ports • 101-key Keyboard • Serial Mouse • MS-DOS 3.3 or 4.01 • Panasonic 1180 printer w/cable • Surge Protector

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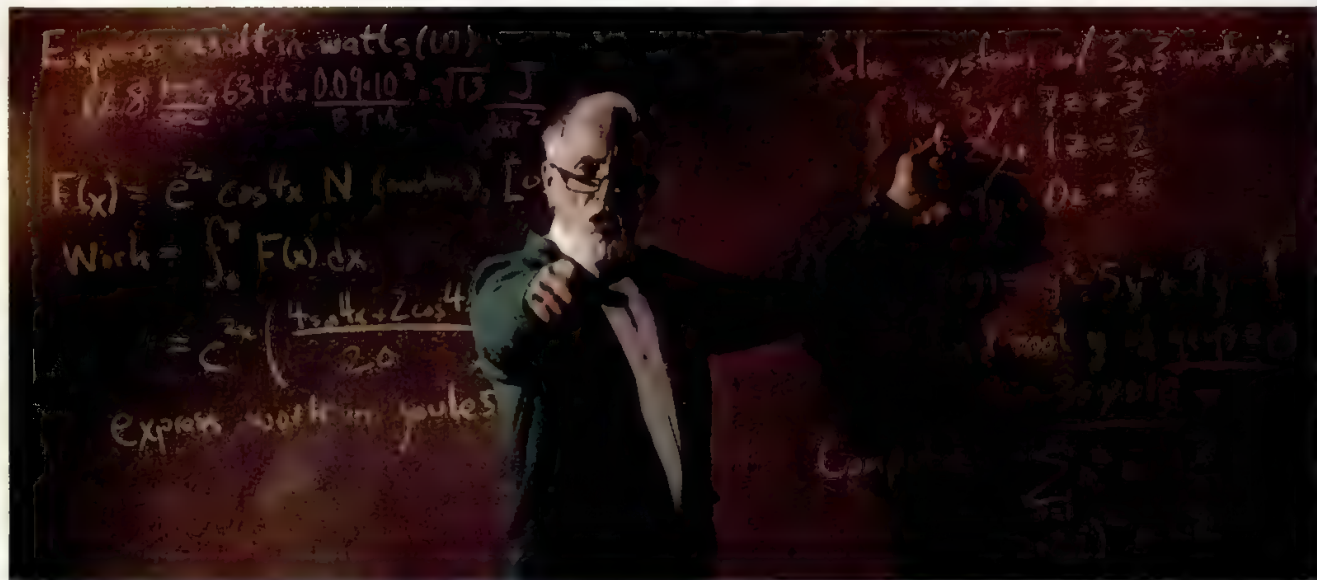
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March 14,
1989 issue.
Best of '87
Best of '87

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PCs

WINNER

This marks the return of the PCs category to the Technical Excellence arena. In the past year, some novel ideas and powerful implementations made up for the lack of real innovation that characterized most of the systems introduced in 1989.

◆ Compaq Systempro

The Compaq Systempro Development Team
Compaq Computer Corp.
20555 S.H. 249
Houston, TX 77070
(800) 231-0900 (dealer locator)

With the Systempro, Compaq has reinvented the file server. The Systempro reaches new levels of system performance and throughput—to the point where server capacity ceases to be an issue for most PC applications. Once again, Compaq has set the standards. The multiple processors, memory capacity, EISA implementation, and disk array technology are already being incorporated into competitors' designs. The ability to handle multiple network interface cards and the enormous 512K cache on the new 33-MHz models virtually eliminate performance bottlenecks. Compaq's support of all the major network operating systems is icing on the cake. This is a premium machine.

FINALISTS

ALR PowerCache Series 4 and 4e

Dave Kelly, Vic Sangveraphunsiri
Advanced Logic Research Inc.
401 Jeronimo
Irvine, CA 92718
(800) 444-4257
(714) 581-6770

ALR's PowerCache technology is a proven winner in the performance race, and you can have it in either Micro Channel or EISA flavors. The 486 really comes to life when fueled by dual 64-bit-wide caches. The synergizing effect of a 128K cache 128 bits wide is truly amazing. ALR's 25-MHz 4 and 4e and the 33-MHz 33/4 and 33/4e come equipped ready to handle your most demanding applications.

CompuAdd 333 and 333T

Rick Foos, Jim Leftwich, John Murphy, Jim O'Quinn
CompuAdd Corp.
12303 Technology Blvd.
Austin, TX 78727
(800) 627-1967

It's always difficult to combine industry-standard expansion with maximum performance. CompuAdd's 33-MHz 333 and 333T incorporate into their design "hot slots" that speed up data transfers (by operating at zero wait states) to the company's 16-bit HardCache/ESDI controller and Hi-Rez VGA card when these cards occupy the hot slots. Interestingly, the hot slots will run at normal AT-bus speed when filled by standard 16-bit cards. Even more intriguing is an SRAM board that sits in a third dedicated slot. It provides 640K of 25-nanosecond SRAM as conventional memory, thereby boosting system performance. It's this kind of innovative thinking that earns CompuAdd its Technical Excellence nomination.

When we sat down to all the lights c

Accurate color scanning seems a simple enough goal. Yet in a flash of engineering brilliance, Epson® designers have raised the standard by creating the ES-300C color scanner.

Using three separate light bars, Epson's innovative TruePass™ scanning system, does in one pass what most other

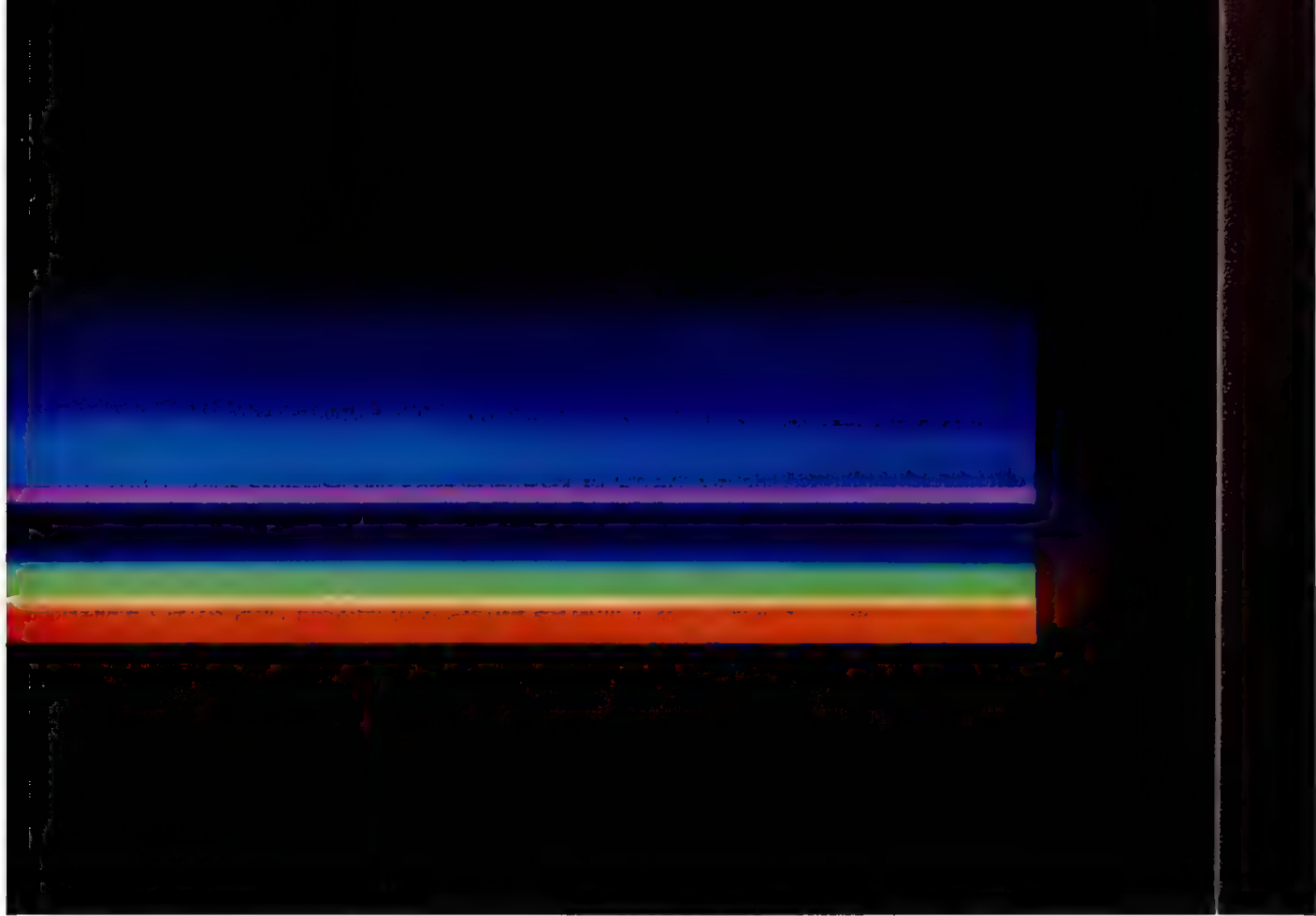
color scanners require three passes to accomplish.

The result is more precise images in less time. Gone are registration difficulties, poor fidelity and color dropout.

*The new EPSON ES-300C
is both MS-DOS and
MACINTOSH compatible.*

The ES-300C is as impressive in black and white or grayscale as it is in color. 256 shades of gray complement 16.8 million colors. Resolution settings can be





design a better scanner, came on at once.

adjusted between 50 and 600 DPI to optimize output from any printer, or to any monitor. Compatibility is assured with a choice of easily installed MS-DOS® or Macintosh® interface kits, featuring the latest industry-leading scanning and editing software.

With a price as attractive as its image would suggest, the full color ES-300C costs about the same as most black and white scanners.

A demonstration of the Epson ES-300C will be an illuminating experience. Other scanners simply pale by comparison.

Engineered For The Way You Work.™

EPSON



TRAVELMATE

SHARP

PORTABLES

Portables are getting more powerful every day. This year, we saw more processor power crammed into smaller form factors, increased battery lives, better displays, and more.

With the strides being made, portables are becoming increasingly capable of serving as users' primary machines.

WINNERS

◆ Sharp PC-6220

◆ Texas Instruments TravelMate 2000

Yoshiyuki Fujikawa, Mamoru Koiko, Robert Levin, Takao Maeda, Hideoyuki Ohashi

Sharp Electronics Corp.
Sharp Plaza
Mahwah, NJ 07430
(201) 529-9500

Elliot Owen, Jack Rawls, Dennie Shadrick, Vaughn Watts

Texas Instruments Inc.
P.O. Box 149149
Austin, TX 78714
(800) 527-3500

Hats off to Sharp and Texas Instruments for designing and building the slickest notebook computer around. The slim 1.4-inch-high case hides a wealth of 286 processing power, disk storage (20MB), and VGA resolution (in the form of Sharp's dazzling backlit triple supertwist LCD). Since it doesn't exactly tip the scales at 4.5 pounds, there's no excuse for leaving it behind. The innards are a masterpiece of miniaturization. We're equally impressed by the PC's well-thought-out ergonomics—from the sensible keyboard layout to the straightforward ports and controls.

FINALISTS

Compaq LTE 386s/20

The Compaq LTE 386s/20 Development Team

Compaq Computer Corp.
20555 S.H. 249
Houston, TX 77070
(800) 231-0900 (dealer locator)

If Compaq had managed to cram any more power into the LTE form factor, it would burst. Instead Compaq engineers are nearly bursting with pride at the strides they've made in miniaturizing and maximizing the power in this little powerhouse. The LTE 386s/20 sports a VGA display, a 20-MHz SX processor, increased battery life, faster charging, better power management, and some unique engineering solutions, such as a flexible circuit board design borrowed from the aerospace industry.

Toshiba T3100SX

Haruhiko Banno, Yuichi Saito, Tsutomu Takenaka

Toshiba America Information Systems Inc.
9740 Irvine Blvd.
Irvine, CA 92713-9724
(800) 583-3000 (dealer locator)

Some products make the race; others make the rules. The T3100SX is a rule-maker. Even though it's no longer the lightest or the fastest in its class, it remains an incredibly rugged workhorse machine with a unique set of features. Toshiba's dual batteries, simultaneous screen and monitor operation, 13MB memory capacity, gas plasma display with excellent gray scaling, math coprocessor socket, and 16-MHz performance have made it the standard by which others are judged. We liked and respected this machine the first time we saw it, and it retains a warm, if weighty, place in our hearts.

In Gothenburg, Sweden...

You'll find a bustling seaport city, thousands of bicycles, reserved yet friendly people and Gateway 2000 computers.

Anders Bjernefors, a computer dealer and programmer, bought a Gateway 2000 25 MHz 486™ system last April.



Anders Bjernefors, owner of Computer Link AB, and his Gateway 2000 25 MHz 486 computer.

"After many faxes and a lot of study," said Anders, "I selected Gateway 2000. I'm pleased with the machine. I received a very powerful, well-built computer for an astonishingly low price."

Anders was so impressed by his system and by the people at Gateway that he contacted the company about becoming a Gateway 2000 reseller for the Nordic countries of Sweden, Norway, Denmark and Finland. "I telephoned my salesman about a dealership," Anders remembered, "and he told me I'd have to visit the factory to make the arrangements. I was on the next plane out of Göteborg on my way to North Sioux City, South Dakota."

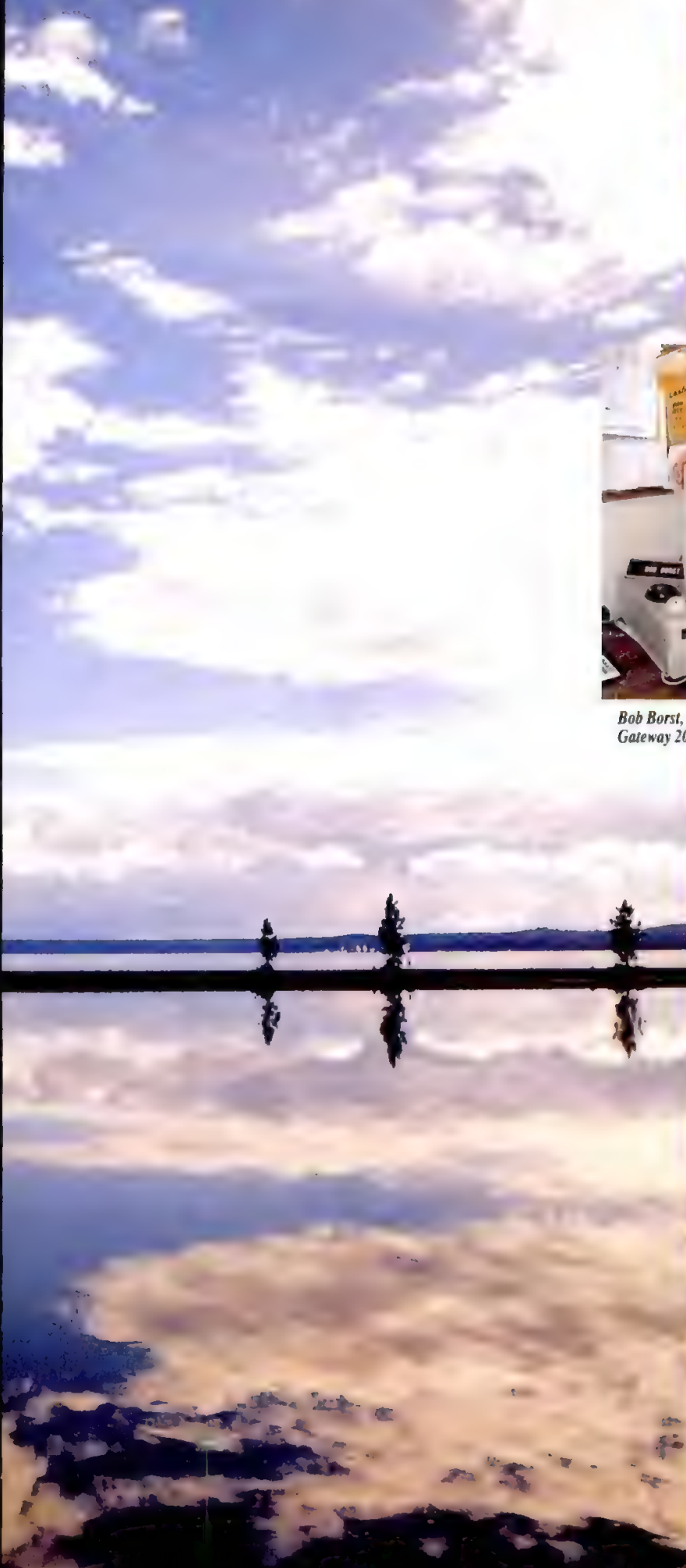
Today, Anders's company, Computer Link AB, sells and services Gateway 2000 products.

Although Gothenburg – or Göteborg in Swedish – is as far north as Siberia, warm ocean currents give the city a mild climate. Residents swim in the North Sea all summer long.



486 is a trademark of Intel Corporation.





And in Worland, Wyoming...

You'll find yourself in the hub of the Big Horn Basin, surrounded by some of the most spectacular scenery in the western United States. You'll see sugar beet farms, petroleum wells and Gateway 2000 computers, too.

Bob Borst, owner and operator of Cloud



Bob Borst, owner and operator of Cloud Peak Pest Control, and his Gateway 2000 386SX.

Peak Pest Control in Worland, spent two and a half months researching his computer purchase. He chose a Gateway 2000 386SX.

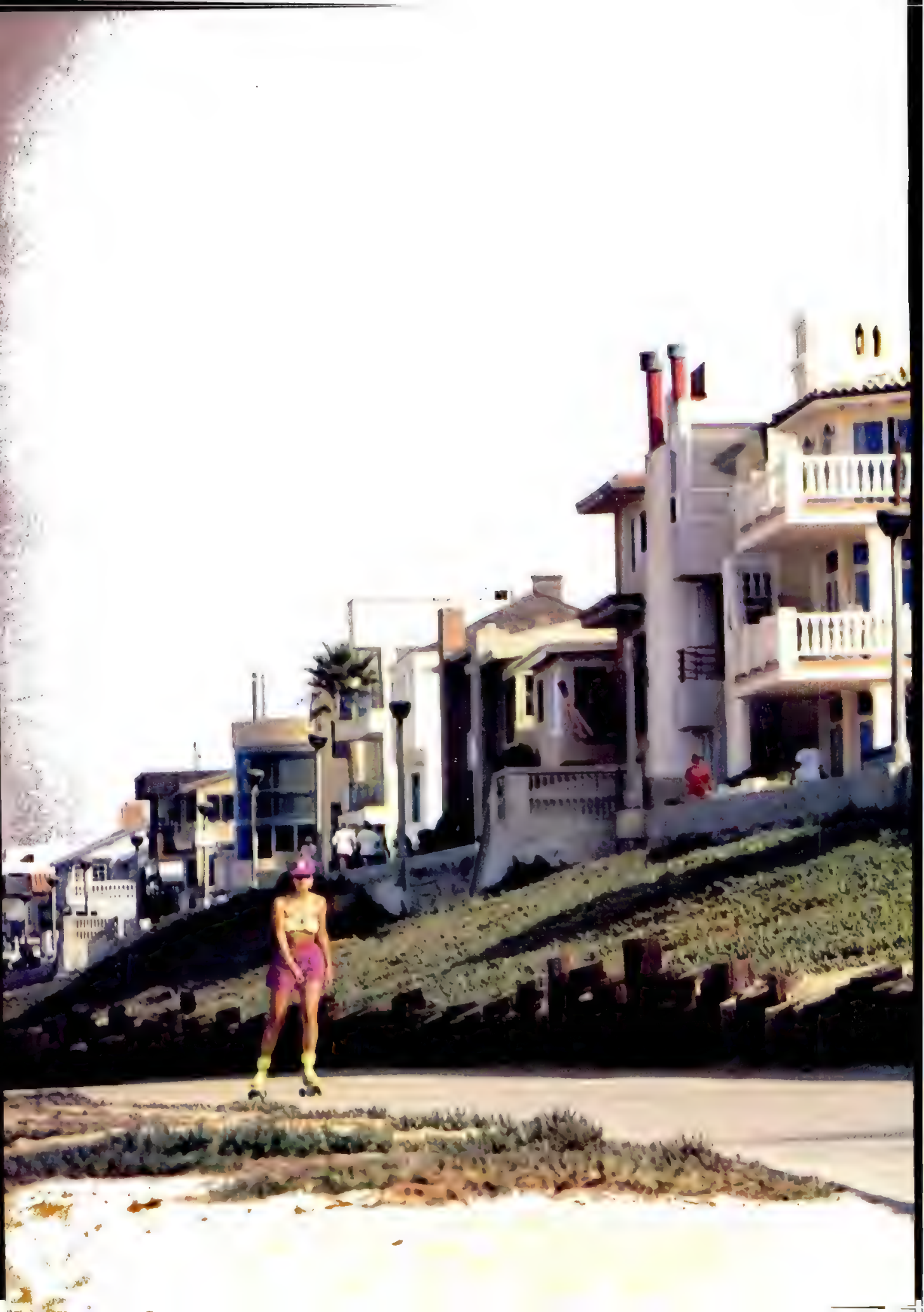
"My final decision was based on people, not hardware," said Bob. "The Gateway people make you feel like you're the most important person in the world. I didn't buy a computer - I bought Gateway."

Bob was equally impressed by Gateway's service people. "One time I got into a file and couldn't get out of it," Bob related. "Even though they're not responsible for software problems, I called Gateway and they talked me through it."

Bob said he'd like to work for Gateway 2000 - and he already has experience in sales. When Bob received his computer, he showed it to his friend Kip who decided to buy one too.

Worland is near Yellowstone, the country's oldest and most famous National Park. Yellowstone Lake is just one of a thousand awesome sights in this treasured preserve.





In Manhattan Beach, California...

You'll find refreshing ocean breezes, seaside skaters, more surfers and another indestructible Gateway 2000 computer.

After the firemen left Bob Baskerville's charred office building, the co-owner of MMB Development Corporation was reluctant to see



Bob Baskerville, MMB Development Corporation, and the Gateway 2000 33 MHz 386™ computer that survived the fire.

what was left of his computers. MMB is a software development company best known for TEAMate™, a UNIX™ bulletin board program. The computers, including Bob's Gateway 2000 33 MHz 386 system, were water-damaged and covered with "black gunk."

"My partner and I took each machine apart," recalled Bob, "washing the components and drying them with freon. One of the few systems to survive this risky procedure was the Gateway – and it's still purring along today as if nothing happened." MMB recovered from the June fire equally well. In October, Release 1.8 of TEAMate was shipped on schedule.

Bob said he lost all of his system manuals in the blaze. When he called Gateway 2000 and explained what happened, the company promptly sent new manuals free of charge.

The ocean-front, called The Strand, is a popular spot for Manhattan Beach skaters, bikers and joggers.



TEAMate™ is a trademark of MMB Development Corporation.
UNIX is a trademark of AT&T. 386 is trademark of Intel Corporation.
GATEWAY 2000 is a trademark of Gateway Corporation.



In Somerset, England...

A two-hour journey west from London, you'll find lush green meadows sprinkled with wild flowers, stone fences, red-jacketed hunters on horseback and Gateway 2000 computers.

This picturesque place is the home of Len Jones, Managing Director of Data Encryption

Systems Ltd. and Gateway 2000 customer. Len operates his company, which provides software protection devices, from his 150-year-old country home located between Cannington and Bridgwater. He uses three Gateway computers in his business – a 25 MHz 386 and two 33 MHz 386 systems.



Len Jones, Data Encryption Systems Ltd., and his Gateway 2000 25 MHz 386 system.

"I looked into three or four American computer companies before I decided to buy a Gateway 2000," Len commented. "When I compared features and prices, Gateway offered the best value. And," he continued, "I liked the selection of systems the company offered."

Len also talked about his initial reluctance to buy a mail order computer. "Europeans are not accustomed to buying through direct mail," he commented. "But I developed a good relationship with my Gateway sales representative and I feel quite comfortable doing business this way now. I've recommended Gateway to a number of people here in the UK."

The London Tower Bridge across the River Thames represents Victorian architecture and engineering at its best.





And in Socorro, New Mexico...

You'll find the New Mexico Institute of Mining and Technology, a small but rigorous school known for science and engineering programs, and Gateway 2000 computers.

Gordon Kane, Laboratory Associate in the Electrical Engineering Department, runs



Gordon Kane, New Mexico Tech Laboratory Associate, with his Gateway 2000 286 lab computers.

student laboratories with 15 Gateway 286 computers and a growing number of Gateway 386 computers.

"We decided to use a modern, PC-based approach for teaching digital and microprocessor electronics," said Gordon. "The quality of Gateway's equipment and their low prices led us to purchase the Gateway computers. This, and the quality of their service, has caused us to continue purchasing computers from Gateway."

New Mexico Tech also uses a Gateway 386 cache computer in research to develop a real-time processor and display system for a sophisticated dual-polarization radar.

"The radar and computer will be used at Kennedy Space Center next summer," said Gordon, "as part of a large program of thunderstorm studies being conducted there by NASA and the Air Force."

In the nearby Magdalena Mountains, NMT uses a Gateway 2000 386 system to support lightning research.



People the World Over

Everywhere you look these days you'll find Gateway 2000 computers. That's because people everywhere know a good value when they see one. In all 50 states and in over 70 foreign countries, thousands of people are comparing price, quality and service—and choosing



Gateway 2000. Compare for yourself.

Price

Examine the last page of this ad, where you'll find a concise listing of Gateway 2000's product line, and compare Gateway's features and prices with any other computer manufacturer. Many competitors try to trick you with low prices on stripped-down systems. Others copy Gateway's features and prices but don't tell you they're using fishy components and building their systems in the back of their brother-in-law's bait shop. When you've had enough of the confusion, call Gateway for some straight talk from a knowledgeable sales person. In a direct comparison, Gateway has the best prices.

Quality

Don't let Gateway's low prices deceive you about quality. Only the highest quality components go into a Gateway 2000 computer. Each system is custom-built

with pride by one of Gateway's Midwest technicians. As the reviews indicate, the quality of a Gateway 2000 system is comparable to the best PC's on the market.

"One of the few systems to survive (the fire) was the Gateway—and it's still purring along as if nothing happened."

Bob Baskerville

"...the company is committed to improving its product line."

Gordon Kane



Computer Shopper readers voted Gateway 2000's 12 MHz 286 and 33 MHz 386 systems Best Buy of 1990.

Service

Of all the factors to consider when selecting a computer, service is perhaps the most important and the most difficult to judge. When customers talk about Gateway 2000, they invariably mention service.

"The Gateway people make you feel like you're the most important person in the world. I didn't

buy a computer

— I bought

Gateway."

Bob Borst

"Gateway's

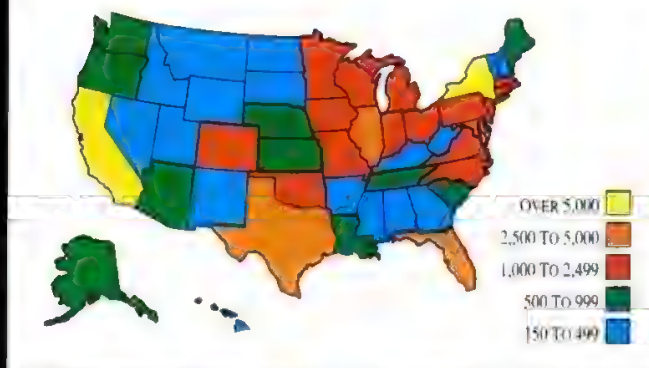
technical

support is

superior."

Gordon Kane

Gateway 2000 New Customers From October 1989 through July 1990



The results of PC Magazine's survey about service and reliability confirm what these Gateway 2000 customers are saying:

Choose Gateway 2000!

"Gateway shared top billing with such heavyweights as Compaq, IBM, and HP for those who would buy their products again...Overall, Gateway's high marks bode well for the company's future, as does its



commitment to customer service."

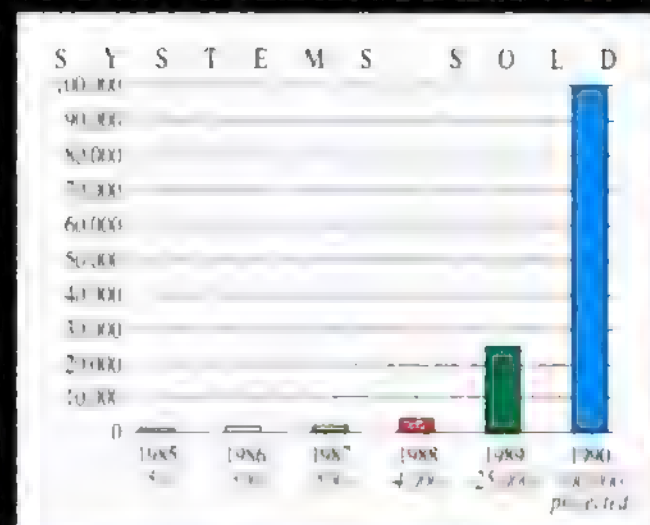
PC Magazine

September 25, 1990

Success

The combination of price, quality and service makes Gateway 2000 the best value in the industry. But value alone doesn't explain how a little company in the Midwest, just celebrating its fifth anniversary, managed to outdistance hundreds of other companies, selling more systems through the direct market channel than any other PC manufacturer in the country.

"It was the cows," laughed Ted Waitt, Gateway 2000 President and CEO. "Of course." Computer magazine readers will remember that the company's



Gateway 2000 sells more computers through the direct market channel than any other PC manufacturer in the country.

run that ad anymore," continued Ted, grinning.

"because we built a new plant 14 miles down the road in South Dakota. But the cows really worked for us.

"In the computer industry, longevity should be measured in dog years."



early ads featured a picture of the Waitt family cattle farm with the headline,

"Computers from Iowa?"

"We can't

They made the phones ring. From then on, though, we built our business on value - good prices on quality systems with old-fashioned, personal service."

Ted mentioned another reason for Gateway's success.

"We take a long-term approach to customer service," he said. "When you buy a computer from Gateway 2000, you become part of our family and we're going to be there for you as long as you own that machine."

As Ted talked about the company's fifth anniversary, he laughed again. "In the computer industry, longevity should be measured in dog years," he chuckled, "because everything's moving so fast. That makes Gateway 35 years old! But seriously, we've come a long way in five years. And I owe it all to the great people at Gateway and to our customers."

Dial the Phone

When you add it all up, you'll understand why people the world over choose Gateway 2000. So pick up the phone and dial. Whether you're from Oklahoma or Portugal, North Carolina or Australia, you've got a friend in the business at Gateway 2000.



Gateway 2000 will be there for you 'til the cows come home.



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GATEWAY 2000 SYSTEMS

12MHZ 286VGA

- 80286-12 Processor
- 1 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 40 MB 17ms IDE Drive with 32K Cache
- 16 Bit VGA with 512K
- 14" 1024 x 768 Color Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01

\$1495.00

GATEWAY 386SX

- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 40 MB 17ms IDE Drive with 32K Cache
- 16 Bit VGA with 512K
- 14" 1024 x 768 Color Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01
- MS WINDOWS 3.0

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25MHZ 386VGA

- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 80 MB 17ms IDE Drive with 32K Cache
- 16 Bit VGA with 1 MB
- 14" 1024 x 768 Color Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01
- MS WINDOWS 3.0

\$2395.00

25MHZ 386CACHE

- 64K Cache RAM
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 80 MB 17ms IDE Drive with 32K Cache
- 16 Bit VGA with 1 MB
- 14" 1024 x 768 Color Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01
- MS WINDOWS 3.0

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33MHZ 386VGA

- 64K Cache RAM
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- 200 MB 15ms IDE Drive with 64K Multi-Segmented Cache
- 16 Bit VGA with 1 MB
- 14" 1024 x 768 Color Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01
- MS WINDOWS 3.0

\$3195.00

25MHZ 486VGA

- 64K Cache RAM
- 8 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 200 MB 15ms IDE Drive with 64K Multi-Segmented Cache
- 16 Bit VGA with 1 MB
- 14" 1024 x 768 Color Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01
- MS WINDOWS 3.0

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- Same features as our 33 MHz 386 VGA system except this machine has an 80 MB 17ms IDE Drive instead of the 200 MB 15ms IDE Drive.

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*If our standard configurations don't fit your needs, we'll be happy to custom configure a system just for you.
Due to the volatility of the DRAM market, all prices are subject to change.*



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COVER STORY
TECHNICAL
EXCELLENCE

PhotoRealistic RenderMan

Development Software for Realistic Computer Graphics



SOFTWARE

This year, it wasn't so much applications software that made things on the other side of hardware interesting. The real excitement lay more with utilities that enhance system performance, programs that advance database functionality, and products that bring photorealistic rendering down to the PC's level.

WINNER

◆ Developer's RenderMan

Tony Apodaca, Ed Catmull, Pat Hanrahan,
Steve Jobs, Mickey Mantle, Darwyn Peachey

Pixar
1001 West Cutting Blvd.
Richmond, CA 94804
(415) 236-4000

Developer's RenderMan is the genius underlying many of today's most advanced graphical software products. It provides a platform-independent solution, describing objects in terms of their geometries and surface characteristics. *RenderMan's* .RIB file format is scalable; the more information you put into it, the more you get out of it. And what you get out if it is stunning. .RIB files can be moved from application to application, and the *RenderMan* routines within each will render the image to the maximum capabilities of the application. Pixar's development of a "shading language" and its library of surface descriptions has dramatically advanced the capabilities of designers everywhere.

FINALISTS

FoxPro, Version 1.02

David Fulton and the FoxPro Development Team

Fox Software Inc.
134 W. South Boundary
Perrysburg, OH 43551
(415) 874-0162

Fox Software has been as crafty as its namesake in constantly advancing the state of *dBASE*-compatible software. *FoxPro* has become a preferred development environment for good reasons: the extensive window support gives character-based applications all the power they need; powerful debugging features make application development rapid and robust; and performance is crisp and responsive. *FoxPro's* developers have labored over the many potential bottlenecks in system performance and have produced a highly tuned, productive environment.

GRAM, Version 1.0

Peter Crowley, Larry Mayer, Gary Pope, Dan Speer,
Mike Wacker

Quarterdeck Office Systems
150 Pico Blvd.
Santa Monica, CA 90405
(213) 392-9851
(213) 392-9701

Many products have followed Quarterdeck's groundbreaking forays into managing 80386 extended memory. None, however, has yet copied *GRAM's* management of EMS 4.0 and EEMS memory. *GRAM* confers 386-like abilities on XT- and AT-class machines. It provides machines in this large installed base with the all-important ability to load device drivers, TSRs, and network drivers into high memory. By addressing this critical need, *GRAM* has extended the viability of millions of PCs.

THE FINE ART OF DISC DRIVES



An artist applies special techniques in

order to create a work of art. Similarly, Seagate has blended a number of advanced technologies into the Swift® family of high-performance 3.5" disc drives.

Designed expressly for high-end PCs and workstations, these half-height drives range in capacity from 80 to 210 megabytes formatted. The drives are available in industry standard ST412, SCSI, AT and ESDI interfaces, which means there is a Swift drive for every application. Our top-of-the-line ST1239, for example, comes in both AT and SCSI versions, making it an ideal drive for advanced workstations.

And it's no coincidence that these drives are named Swift: every drive in the family boasts a 15 msec. average access time. They also feature Seagate's proprietary thin-film discs, spindle motors, rotary voice coil actuators and patented dedicated servo technology for maximum performance and reliability.

No one knows more about the fine art of disc drives than Seagate. For complete product specifications, contact your authorized Seagate distributor, or call Seagate directly: 800-468-DISC, or 408-438-6550. But don't delay; like their name, these drives are bound to go fast.



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COVER STORY
TECHNICAL
EXCELLENCE

AWARDS FOR TECHNICAL EXCELLENCE:
PREVIOUS WINNERS

Year	Product	Company	Category
1989			
	Audio Visual Connection	IBM Corp.	Hardware
	Autodesk Animator	Autodesk Inc.	Graphics
	Joseph R. Canion	Compaq Corp.	Person of the Year
	IBM LaserPrinter	IBM Corp.	Printers
	Magellan	Lotus Development Corp.	Utilities
	MultiScope OS/2 Debugger	Logitech Inc.	Development Tools
	NetWare 386, Version 3.0	Novell Inc.	Connectivity
	OS/2, Version 1.2	IBM Corp.; Microsoft Corp.	Operating Environments
	The Poqet PC	Poqet Computer Corp.	Portables
	Quattro Pro	Borland International Inc.	Applications
	Roland LAPC-I	Roland Corp. U.S.	Entertainment/After Hours
	John Warnock	Adobe Systems Inc.	Lifetime Achievement

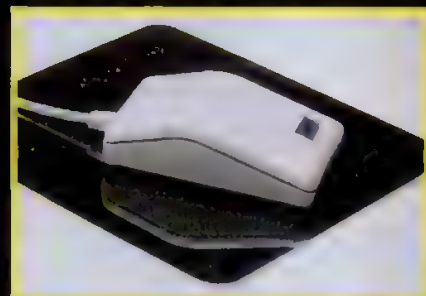
1988			
	All Chargecard	All Computers	Add-in Boards
	ALR FlexCache 25386	Advanced Logic Research Inc.	Desktop Machines
	Intel 80386 Design Team	Intel Corp.	Persons of the Year
	Kurta IS/1 Cordless Stylus/Puck	Kurta Corp.	Hardware
	Lahey FORTRAN 286 and 386	Lahey Computer Systems Inc.	Compilers/Languages
	Micrografx Designer	Micrografx Inc.	Graphics Software
	Microsoft Mouse	Microsoft Corp.	Design
	NEC UltraLite	NEC Home Electronics (U.S.A.) Inc.	Portables
	Q&A 3.0	Symantec Corp.	Application Software
	Dennis Ritchie	AT&T Bell Laboratories	Lifetime Achievement
	SunRiver Workstation	SunRiver Corp.	Connectivity
	Turbo Debugger	Borland International	Development Tools
	VM/386	Intelligent Graphics	386 Software

1987			
	AutoShade	Autodesk Inc.	Graphics Software
	Compaq Portable 386	Compaq Computer Corp.	Portable Computers
	Compaq Deskpro 386/20	Compaq Computer Corp.	Desktop Computers
	Douglas Englebart	McDonnell Douglas Information Systems Group	Lifetime Achievement
	LIM expanded memory specification 4.0	Lotus Development Corp., Intel Corp., Microsoft Corp.	Utilities
	Lucid 3D	Personal Computer Support Group	Application Software
	Micro Channel architecture	IBM Corp.	Special Award

CONTINUES

New!

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Sleek, dependable and compatible. The PC Mouse III from Mouse Systems.

Pin-point digitizer accuracy using patented M5 optics. Supports Microsoft™, MSC, and PS/2 protocols. 100% hardware and software compatibility guarantee. True lifetime warranty. Get your hand on the world's most accurate mouse today!



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Offer

Buy a PC Mouse III and receive a free copy of Power Panel™ the ultimate DOS utility shell (PC Magazine Editor's Choice, June 12, 1990.)



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The following are trademarks of their respective companies: PC Mouse III, Power Panel, Mouse Systems Corporation, Microsoft, Microsoft Corporation, PS/2, IBM

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She's 5 years old.
She's already had
7 names,
16 identities and
21 homes.



Ad
Council

Every year thousands of children are kidnapped by their own parents. Beginning the tragic ordeal of life on the run. Child Find offers an end to the running. With our toll-free number and our mediation program, we offer a way out for the parents and for the kids.

For us, it's a labor of love. But unfortunately, we can't operate on love alone.

To find out how you can help, or if you need our help, please call 1-800-A-WAY-OUT. And help another child find a more peaceful future.



CHILD FIND OF AMERICA INC.

COVER STORY TECHNICAL EXCELLENCE

AWARDS FOR TECHNICAL EXCELLENCE: PREVIOUS WINNERS

1987

<i>Microsoft Excel for Windows</i>	Microsoft Corp.	Application Software
<i>Microsoft Windows/386</i>	Microsoft Corp.	Operating Environments
<i>Publisher's Type Foundry</i>	ZSoft Corp.	Desktop Publishing
<i>QuickBASIC 4.0</i>	Microsoft Corp.	Development Tools
<i>3Com 10Mb Twisted Pair</i>	3Com Corp.	Connectivity
<i>Turbo Pascal 4.0</i>	Borland International	Development Tools
<i>Zenith Perfect Monitor, Model ZCM-1490</i>	Zenith Data Systems	Hardware

1986

<i>Advanced Netware/286</i>	Novell Inc.	Networking
<i>Compaq Deskpro 386</i>	Compaq Computer Corp.	Desktop Computers
<i>Bill Gates</i>	Microsoft Corp.	Special Award
<i>HAL</i>	Lotus Development Corp.	Software Add-ons
<i>Microsoft Windows 1.03</i>	Microsoft Corp.	Environments
<i>NEC MultiSync</i>	NEC Home Electronics Inc.	Graphics Hardware
<i>NewViews</i>	Q.W. Page Associates Inc.	Application Software
<i>Perspective</i>	Three D Graphics	Graphics Software
<i>QuickBASIC 2</i>	Microsoft Corp.	Programming Languages
<i>TIPS</i>	Island Graphics Corp.	Graphics Software
<i>Toshiba T3100</i>	Toshiba America Inc.	Portable Computers
<i>What's Best</i>	General Optimization Inc.	Software Add-ons
<i>Zenith Z-181 Portable PC</i>	Zenith Data Systems	Portable Computers

1985

<i>Apple LaserWriter</i>	Apple Computer Inc.	N/A
<i>Mike Brown</i>	Central Point Software	Special Award
<i>EGA CHIPSet</i>	Chips and Technologies	N/A
<i>Freelance</i>	Lotus Development Corp.	N/A
<i>IBM Proprinter</i>	IBM Corp.	N/A
<i>Javelin</i>	Javelin Software Corp.	N/A
<i>LANLink</i>	The Software Link Inc.	N/A
<i>Plus Hardcard</i>	Plus Development Corp.	N/A
<i>Trailblazer modem</i>	Telebit Corp.	N/A

1984

<i>Enable</i>	The Software Group	N/A
<i>Framework</i>	Ashton-Tate	N/A
<i>Infoscope</i>	Microstuf	N/A
<i>Intel 80286</i>	Intel Corp.	N/A
<i>PC Blue Series</i>	(Public domain)	N/A
<i>Turbo Pascal</i>	Borland International	N/A

N/A—Not applicable: Winners were not designated by category in 1984 and 1985.

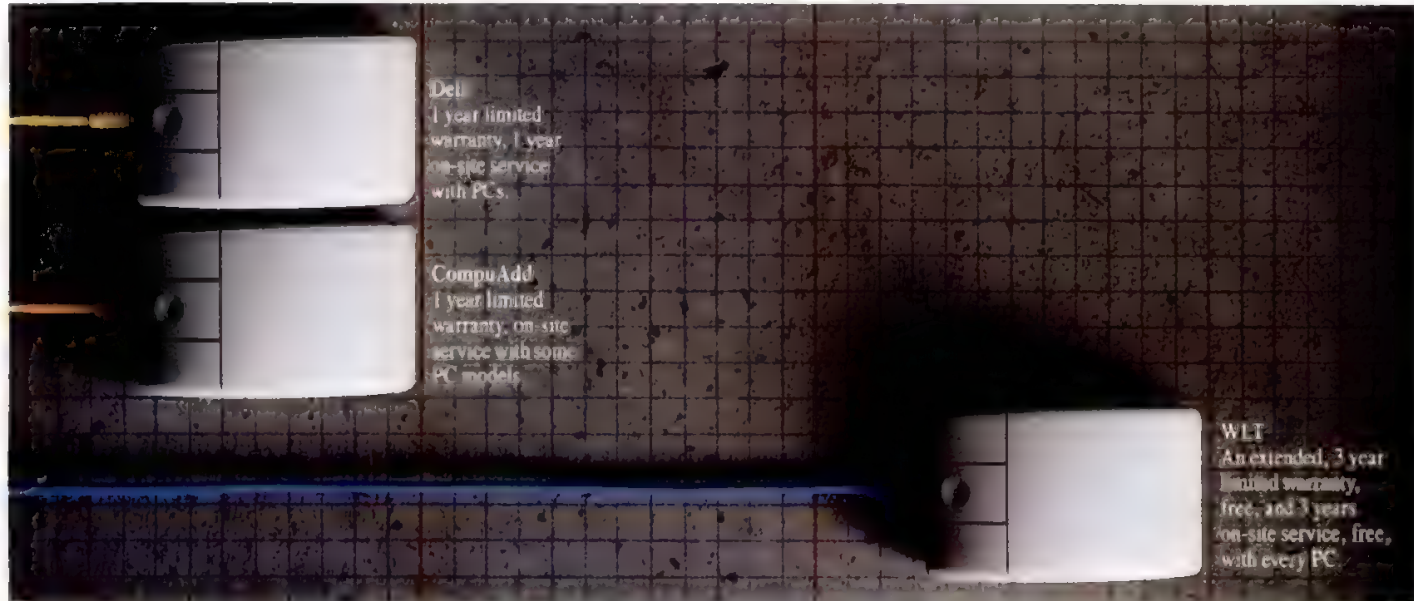
ENDS

The odds that you'll favor WLT over Dell or CompuAdd are 3-1.

1 Year
Warranty

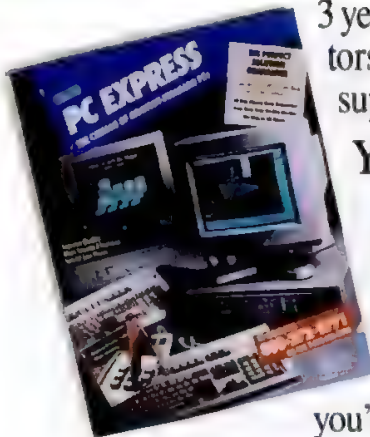
2 Year
Warranty

3 Year
Warranty



WLT PC Express' free 3 year warranty gives you the advantage.

When you're buying PCs by mail, consider this: only WLT PC Express offers you a 3 Year Buyer Protection Plan. So you'll receive free next-day, on-site service, and free parts and labor on your CPU, monitor and controller, keyboard, and drives purchased with the CPU—for a full 3 years. That's 3 times the service you can expect from our top competitors. At no extra charge. That's how much confidence we have in the superior quality and reliability of every PC we produce.



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PERSONS OF THE YEAR

Finis Conner
Conner Peripherals

Terry Johnson
PrairieTek

Two companies have done more than any others to change the shape of personal computing this year: Conner Peripherals and PrairieTek. Without their pioneering development of two-and-a-half-inch hard disks, the current crop of light, rugged, powerful notebook computers would still be a dream. Producing these drives has been a far more intensive task than the usual shrinking process. Serious research into materials science, integrated drive electronics, custom circuitry, head design, and packaging was a necessary fore-runner. Our winners had to manage not only technical development but also tremendous growth as the industry enthusiastically adopted their products. Notebook computers are an explosive growth area; Connor and Johnson played a major role in making it so.



Finis Conner

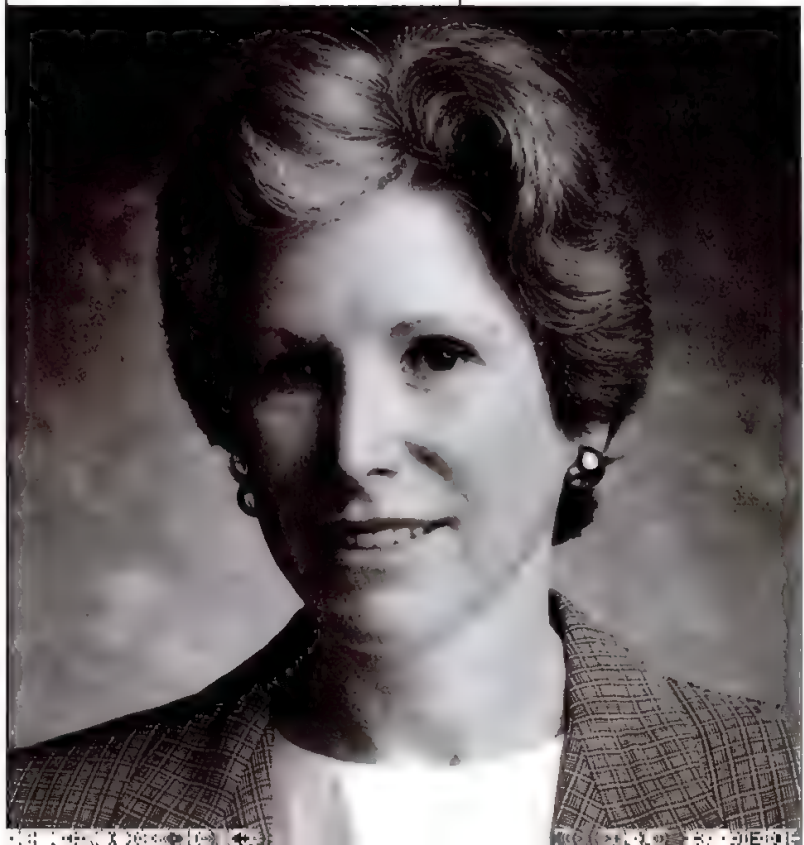


Terry Johnson

LIFETIME ACHIEVEMENT

Adele Goldberg

In her 14 years at Xerox's Palo Alto Research Center, Adele Goldberg was heavily involved in the development of Smalltalk-80. Dr. Goldberg managed the System Concepts Laboratory, and over the years, the concepts she developed have influenced not only Smalltalk, but many other languages and software development platforms. Object orientation, reusable code, and the ability to tailor a programming language to the needs and goals of the user are but a few of her important contributions. We salute Dr. Goldberg for her achievements in furthering the theory and practice of communicating with computers.



Everything You Ever Wanted In UNIX. And Less. \$99.95*

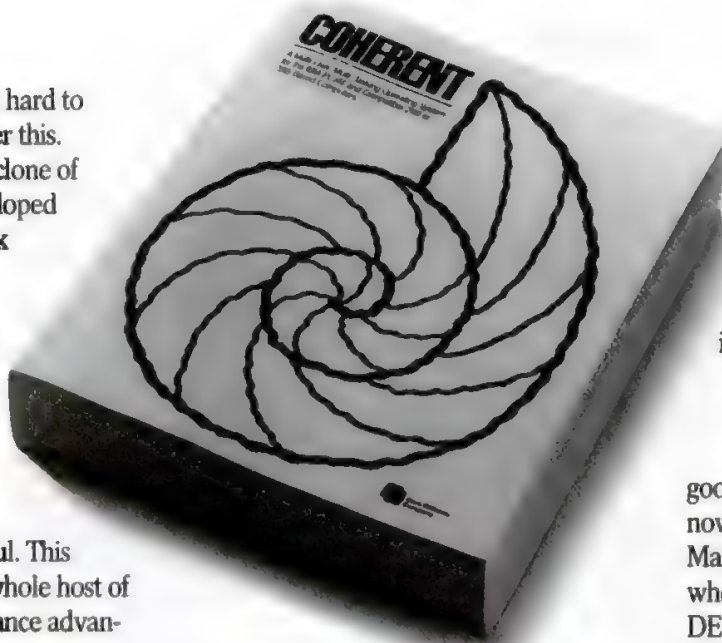
OK. We know it's hard to believe. So just consider this. Coherent™ is a virtual clone of UNIX. But it was developed independently by Mark Williams Company. Which means we don't pay hundreds of dollars per copy in licensing fees.

What's more, Coherent embodies the original tenet of UNIX: small is beautiful. This simple fact leads to a whole host of both cost and performance advantages for Coherent. So read on, because there's a lot more to Coherent than its price.

SMALLER, FASTER... BETTER.

Everybody appreciates a good deal. But what is it that makes small so great?

For one thing, Coherent gives you UNIX capabilities on a machine you can actually afford. Requiring only 10 megabytes of disk space,



Coherent can reside with DOS. So you can keep all your DOS applications and move up to Coherent. You can also have it running faster, learn it faster and get faster overall performance. All because Coherent is small. Sounds beautiful, doesn't it?

But small wouldn't be so great if it didn't do the job it was meant to do.

EVERYTHING UNIX WAS MEANT TO DO.

Like the original UNIX, Coherent is a powerful multi-user, multi-tasking development system. With a complete UNIX-compatible kernel which makes a vast world of UNIX software available including over a gigabyte of public domain software.

Coherent also comes with Lex and Yacc, a complete C compiler and a full set of nearly 200 UNIX commands including text processing, program development, administrative and maintenance commands.

And with UUCP, the UNIX to

UNIX Communication Program that connects you to a world-wide network of free software, news and millions of users. All for the cost of a phone call.

We could go on, but stop we must to get in a few more very important points.

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Wondering how something as good as Coherent could come from nowhere? Well it didn't. It came from Mark Williams Company, people who've developed C compilers for DEC, Intel, Wang and thousands of professional programmers.

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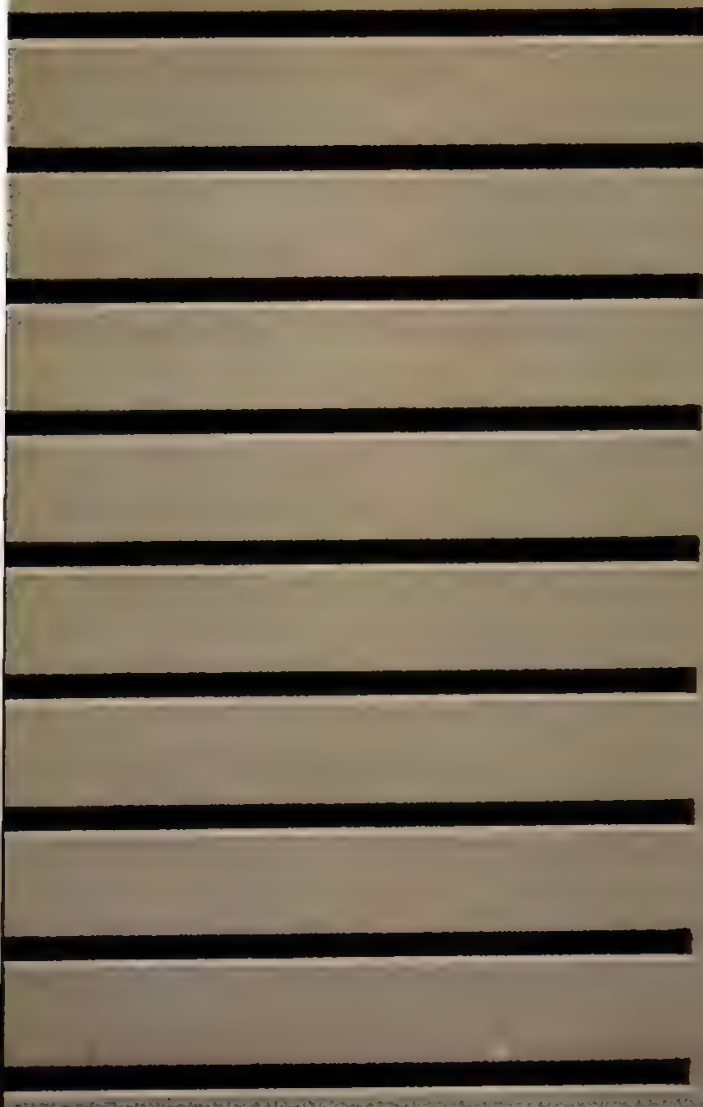


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Company**
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Northbrook, IL 60062

*Plus shipping and handling. Coherent is a trademark of Mark Williams Company. UNIX is a trademark of AT&T. XENIX is a trademark of Microsoft.

LESS IS MORE!	Coherent For the IBM-PC/AT and compatible 286 or 386 based machines.	Santa Cruz Operation's XENIX 286, Version 2.3.2
No. of Manuals	1	8
No. of Disks	4	21
Kernel Size	64K	198K
Install Time	20-30 min.	3-4 hours
Suggested Disk Space	10 meg	30 meg
Min. Memory Required	640K	1-2 meg
Performance*	38.7 sec	100.3 sec
Price	\$99.95	\$1495.00

*Byte Exec benchmark, 1000 iterations on 20 MHZ 386.
Hardware requirements: 1.2 meg 5¼" or 1.4 meg 3½" floppy, and hard disk. SCSI device driver available soon. Does not run on Microchannel machines.



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The Tandon 486/33.

An awesome computer designed from the ground up around the top of the line Intel® 80486 processor. But processing at a speed of 33 MHz. And we didn't stop there.

We added our exclusive MultiCACHE™, a 64k external cache that accelerates processor read operations even more.

And we didn't stop there. We put it into high gear with the proprietary Tandon PowerPoster™. A unique write buffer that speeds up write operations to RAM.

And then to make things really fly, we combined a 64 bit bus (double the width) with the latest EISA technology to boost performance to previously unheard of levels. As much as

two times faster than a 386.

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ranty, on-site service, and 24-hour telephone tech support for life. We even offer a special leasing program. And if for any reason you're not pleased, you can get a full refund within the first 30 days.

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Or ask about our 386/33 for \$3999 or 386/25 for just \$3599. And be treated to one of three top performances daily.

\$7,299

- 30-Day Money Back Guarantee
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- 1-Year Limited Warranty
- On-Site Service
- Leasing Program Available

Tandon 486/33

ND A MACHINE THE TANDON 486/25.

Tandon 486/33 • Price includes: System unit, 4MB RAM; 200MB IDE hard drive; 1.2MB or 1.44MB diskette drive; VGA monochrome monitor; 16-bit video card; keyboard; power cord; Microsoft® Windows™ 3.0, and serial mouse; operation and installation manual; Tandon MS-DOS software and manual. • **Upgrade options:** 2MB and 8MB memory upgrade kits (to 64MB); 330MB, 600MB, and 1GB SCSI hard disk drives; 650MB ISO-approved optical drive and cartridge; VGA and Super VGA color monitors; graphics accelerator card; 2400 baud modems; network cards; laser printers. **Tandon 386/33 and Tandon 386/25.** • Price includes: System unit; 4MB RAM (Tandon 386/33); 2MB RAM (Tandon 386/25); 110MB IDE hard drive; 1.2MB or 1.44MB diskette drive; VGA monochrome monitor; 16-bit video card; keyboard; power cord; Microsoft® Windows™ 3.0 and serial mouse; operation and installation manual; Tandon MS-DOS software and manual. • **Upgrade options:** 1MB and 4MB memory upgrade kits (to 16MB); 80387 math coprocessor; additional 1.2MB and 1.44MB diskette drives; 200MB IDE, 330MB ESDI hard drives; VGA and Super VGA color monitors; graphics accelerator card; 2400 baud modems; network cards; laser printers. Tower models available. **Please call for information.**

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- Hard Drives, Diskette and Optical Drives
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- Coprocessors
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- Additional Options Available On All Systems. Please Call.

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Genius... Bringing Your Imagination To Life.



Finally, a hand-held scanner for all jobs. Color or black and white, no problem! The GS-C105 color scanner brings your images to life with the help of ingenious color/black and white editing and enhancement software. Scan in vivacious color or black and white images in 256 colors or 256 shades of grey. Once the image has been scanned, put your inventiveness to work. Tailor scanned images to suit your needs. Once you have perfected your image, transfer it to different file formats: TIFF, PCX, MSP, CUT, IMG, and EPSF. The GS-C105 displays 100-400 DPI resolution in increments of

10 DPI. Full page scans are completed with ease. A flatbed scanner is no longer a necessity. With Genius, you get everything you expect from a flatbed scanner at less than half the price (\$699). Simply - Genius! What more could you ask for in a scanner? The GS-C105 supports all IBM PC AT compatibles, 1 Bus slot, 640KB RAM, hard disk, EGA/VGA video display adapter, MS DOS version 2.1 or later, and EMS 4.0. iPhoto requires Windows 2.x or above. To place an order or for more information phone (800) 456-7593.



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COVER STORY
BEST OF 1990

BEST —OF— 1990

by Bill Howard

In 1990, PCs got smaller, *Windows* got bigger, standards stayed fuzzy, and software development in general continued to lag behind hardware advances.

Two steps forward. One step back. The computer industry in 1990 resembled nothing so much as a giant children's game, with each advance matched by some delay. Every new PC platform yielding more mips only made the lack of progress in the software industry more conspicuous. Mixed blessing that it was, 1990 proved a better year than 1989. On the whole, we're better off at the start of 1991 than we were exactly one year ago.

Not only PCs, but video cards, monitors, printers, and network connections have grown more powerful and more affordable each year. 1990 proved a watershed year with the advent of the \$2,000 386 PC and the \$1,000 laser printer. But breakthrough software is lacking, and ease of use remains an elusive quality that more and cheaper mips don't address.

As the PC industry approaches its tenth birthday in 1991, four issues stand out. Ease of use is one of them; portability, connectivity, and bang for the buck are the others.

PORTABILITY

More and more, the PC of choice has a handle and a battery. Sales of notebook, laptop, and portable PCs will grow by more than a third in each of the next several years—about three times as fast as desktop PCs. That's because portables now pack most of the power of the desktop in a case you can carry away: 80386 or 80386SX processors, VGA displays, 100MB-plus hard disks, and 4MB-plus of RAM. Toshiba introduced a \$9,499 color version of its 20-MHz 386 AC portable, the T5200, which added only about \$1,000 to the older system's price—a breakthrough since previous color portables were about \$2,500 more costly. The price of the color model also includes a 200MB hard disk.

At year's end, Compaq, Texas Instruments, and Sharp had introduced 20-MHz SX notebooks weighing less than 8 pounds. The biggest breakthrough here has been the development of 2.5-inch hard disks weighing less than 10 ounces from Conner, PrairieTek, and others. With the integration of multiple chips into one,

COVER STORY BEST OF 1990

even further downsizing of portables is likely in the future. Look for Intel's 386SL Microprocessor Superset—the 386SL has the core functions of the SX chip and integrates a cache and main memory controller and a 387SX coprocessor inter-

*One of 1990's
successes is
LANtastic, a network
operating system that
does just about
everything right.*

face; the 82360SL I/O subsystem chip provides serial, parallel, and other functions. One area where progress remains slow is battery technology: Virtually all gains to date have come from making portables use less power rather than making batteries provide more.

CONNECTIVITY

The bulk of PCs sold into the business market are destined to be connected to other PCs, or to minicomputers or mainframes. To oversimplify only a bit, network configurations fall into two categories and two levels of complexity: smaller arrangements of a half-dozen users, and larger groups of many dozens of users; simpler file-sharing and messaging needs, and more complex intra-workgroup communication and shared processing.

One of 1990's success stories has been the explosive popularity of Artisoft's *LANtastic* peer-to-peer network operating system, a product that does just about

everything right. It offers affordability, ease of installation, more-than-adequate throughput with the optional Ethernet interface cards, and has modest memory requirements (13K for most users, 40K for the file-server PC). At the high end, Novell's *NetWare/386* (Version 3.0 was last year's Technical Excellence Award winner for Connectivity) and Microsoft's *LAN Manager 2.0* (a Technical Excel-

lence Award finalist for Connectivity this year) have evolved to the point where you can't pick a winner based on features or performance. The sales leader, however, continues to be Novell's *NetWare/286*. For many users, it provides all the horsepower they need—and at a more attractive price than *NetWare/386*. Banyan's *VINES*, a good choice for large, far-flung networks, had been running a weak third to the *NetWare* siblings and *LAN Manager*, but it gained new support—and new life—with a version designed exclusively for the multiprocessor version of the Compaq Systempro.

While the future of connectivity may be sophisticated client/server applications, for many users, just getting the network to run at all has been a more pressing issue. Even the high and mighty aren't immune. At NetWorld in Dallas in September, the showcase demonstration network, called *ShowNet*, which was to link 400 exhibitors, proved minimally functional for part of the industry's premier networking show.

The math coprocessor
PC Week rated #1.

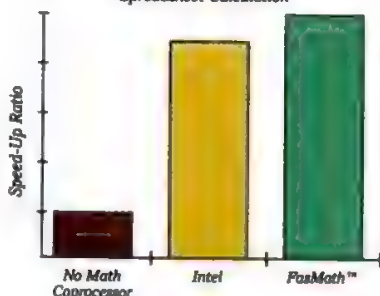
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EASE OF USE

Many users still have problems getting their PC equipment to perform some of the most routine business tasks. The blame can usually be placed on powerful software or hardware that lacks ease of use, or easy-to-use software that gives up too many capabilities.

Consider, for instance, routine office correspondence. Few word processors have complementary databases that let you look up a name and address and transfer that information to the body of a letter; of the ones that do, you're typically restricted to that vendor's proprietary list manager. Similarly, most word processors still lack a simple routine for printing addresses on envelopes. And the vast majority of laser printers are ill equipped to handle the common business letter that requires separate bins for the letterhead, continuation sheets, and envelopes.

Before it shipped May 22, *Windows 3.0*—surely one of the year's worst-kept secrets—was touted as the equalizer that was to make the PC as user-friendly as the Mac. That didn't turn out to be the case. *Win 3* made the PC *easier* to use, but not easy to use.

An aside to this is that even with the advent of lower-cost Macs at year's end, the PC enjoys at least as great a price advantage over the Mac as the Mac holds over the PC when it comes to ease of use. The PC has other advantages, too. With the exception of graphics and publishing applications, the bulk of today's software development is aimed at the PC because that's where the money is. Since the PC outsells the Mac 10 to 1, a developer can generate equal amounts of revenue capturing 10 percent of the Mac market or 1 percent of the PC market.

Some of the year's most successful products gave us ease-of-use breakthroughs rather than stunning technological advances. Witness:

◆ Intel's NetPort, an adapter that hooks a laser printer directly to an Ethernet network to accept jobs from workstations. Intel licenses the technology from Microtest (which sells its adapter as the LAN-Port), and uses a modified design. While other vendors preceded Intel to market

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with similar products, the success of the Intel-branded NetPort device shows that users still place a premium on brand names they feel comfortable with.

Xircom's pocket network adapters that connect through the parallel port of a

Magazine editor-in-chief Bill Machrone, holds that the PC you *really* want has always cost \$5,000. Step back from the leading edge of technology and the best-known brands, however, and you can find capable, powerful machines for half that. Street prices for 16- and 20-MHz 80386SX and 20-MHz 80386 PCs with VGA color displays and hard disks now stand at \$2,000 or less. Prices are coming down at the high

Many successful products offered ease-of-use breakthroughs rather than technological advances.

laptop or desktop PC and don't require fiddling with interrupts or jumpers. The success of Xircom, a start-up, lets us draw another moral: Users will pay a premium for no-hassle products that ultimately save money when you factor in the cost of setup and support.

◆ QMS's PS-410 laser printer that automatically switches between LaserJet and PostScript emulation. Any user looking at the character stream could immediately distinguish between the two, but until the PS-410, no printer could do so.

BANG FOR THE BUCK

Given that the actual cost of equipping and supporting a PC over its typical five-year lifespan may be ten times the purchase price, it doesn't make sense to buy under-equipped, underpowered PCs. That's especially true now that PCs are so affordable relative to what they cost only a year or two ago.

Machrone's Rule, postulated by PC

end, too. IBM used rebates and software bundles to cost-reduce its PS/2s, and Compaq followed with the broadest price cuts in its history—about 20 percent. While Compaq and IBM each say their real competition is each other, they're also aware that buyer resistance stiffens as the price gap increases among PCs.

Printers, video subsystems, modems, and other hardware have reached price points that would have been unbelievable only a year ago: \$1,500 list (less than \$1,000 street price) for 4-page-per-minute laser printers such as the HP LaserJet IIP; \$99 for ATI's 16-bit VGA card; and a slew of 9,600-bit-per-second modems with sophisticated error correction selling in the \$600 to \$700 range.

Conversely, software has held the line on price and in some cases edged upward. For instance, state-of-the-art word processors sold for \$200 to \$250 (street price) one and two years ago; Microsoft's *Word for Windows*, arguably the most sophisticated, capable, and complex of the new



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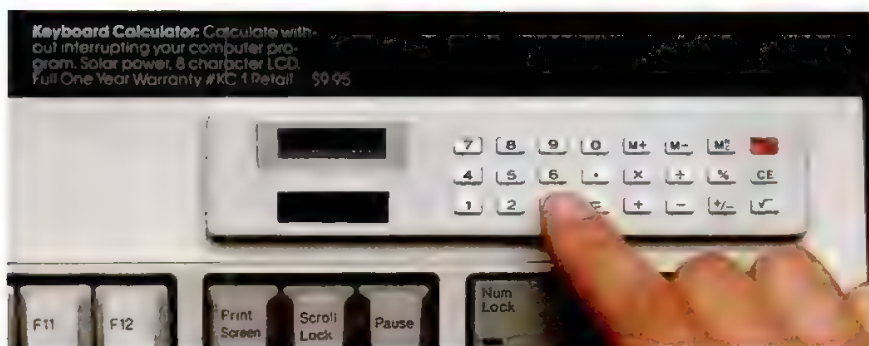
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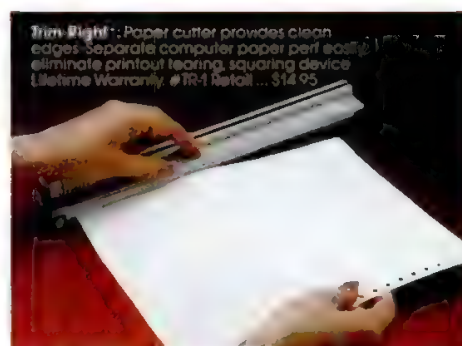
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WHAT'S AHEAD: 1991

A look ahead to the hot products and trends in the PC industry in 1991.

by Gus Venditto

The big story in 1990 was *Windows* and, guess what? It's also going to be a major factor in 1991. The year ahead is filled with tantalizing promises—an explosion of PC-based multimedia presentations, advances in laptop technology—and more.

◆ The release of *Windows* versions of *WordPerfect* and *Lotus 1-2-3* will help *Windows* reach five million systems before the year is out.

◆ The real question is whether or not *Windows*' power to direct the market toward OS/2 will kick in yet. It probably won't happen until 1992, but there should be some early signs of the transition toward the end of the year. It will take at least six months after OS/2 2.0 is introduced before we'll have a clear sense of whether or not this, the first 32-bit version, is going to be the winner that finally carries OS/2 into the mainstream.

◆ Strong growth in Unix applications will continue, even though it has virtually no impact on the growth in DOS-based computing. Both DOS and Unix have grown on the PC at almost the same rate for years, and that should continue for at least the next year.

◆ You can expect RAM prices to remain low. SIMM pack prices won't change very much, though prices of older forms of RAM, like 64-kilobit and 256-kilobit chips, will stay on a slide.

◆ The cost of math coprocessors will

come down, too, as competition in the market heats up. This, and the 486 chip's internal 387 instruction set, will lead more programmers to off-load floating-point operations to a coprocessor.

◆ The heat will turn up on multimedia applications. If there are any early winners, the floodgates will open for software and hardware that use CD-XA (compact disk extended architecture) for audio and video, and MIDI for music.



Even here, *Windows* is likely to be a major factor since the multimedia extensions that Microsoft acquired from Macromind will be released in 1991.

◆ By late 1991, we'll see the slick slide shows at today's meetings outclassed by MTV-inspired multimedia presentations, prepared with upgrades of today's programs.

◆ Digital audio tape will become a factor in backup; lower prices for DC-6000 will make this the midrange, while DAT becomes the high end.

◆ Ultra-high-density 3.5-inch disks (higher than 1.4MB) will struggle for acceptance; it's likely that users will

reject the attempts to add a fifth disk format.

◆ Laptops will continue to get smaller, cheaper, and more powerful. The major trend of 1991 will be a flood of hard-disk-equipped notebooks from direct marketers that will take market share away from Toshiba, NEC, and Compaq.

◆ At the high end, laptop makers will make improvements in LCD panel speed, doing away with cursor blur.

◆ By the end of the year, we should see thin-film-transistor (TFT) manufacturing perfected to the point where CRT-quality color appears on laptops. It will be another year before it becomes common.

◆ One of 1991's most enduring trends will be the effort to seamlessly integrate the fax into the PC's laser-printer-centric environment. At least a half dozen ideas will come to market, exploring everything from linking a scanner with a fax machine to putting all the com-

ponents (fax, scanner, laser printer, copier) into one box.

◆ PC manufacturers will develop a variety of server designs, most of them similar to Compaq's Systempro.

◆ Designs for desktops will tend toward modular components and plug-in processor boards, retreating from the motherboard fixation of the past few years.

◆ Finally, a favored topic of speculation for the year will be the 80586—what will it do, and when will it appear? Next year at this time, we should know what it will do, but we'll still be speculating on when it will appear.

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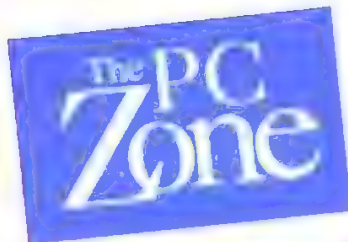
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generation of word processors, sells for about \$350 today. Spreadsheets have been the rare exception to the "more costs more" rule. Borland has aggressively promoted a trade-up or trade-across policy that provides a new copy of *Quattro* for \$99 to anyone who can dig up a sheet—any sheet—from any spreadsheet manual. Lotus CEO Jim Manzi denounced other spreadsheet vendors for "undermining the value" of software with such tactics. However, most other spreadsheet vendors are matching Borland's offer—some publicly, some privately—in special corporate trade-up programs. Even Lotus.

WINDOWS JUGGERNAUT, OR OPERATING SYSTEM CONFUSION

Version 3.0 of *Microsoft Windows* was arguably the most successful new product of 1990. Since its release, most major new software products announced for the PC have been based on *Windows* rather than DOS. Vendors who believed that the migration path for users was from DOS to OS/2, bypassing *Windows*, scrambled to develop *Windows* versions. Lotus and Software Publishing were two of the most prominent scramblers.

Reflecting the reality of weak OS/2 sales, Microsoft and IBM realigned their working relationship for developing present and future operating environments. This rift or pragmatic agreement (depending on your perspective) has Microsoft pulling back from OS/2 development to concentrate on *Windows* and DOS. IBM will be chiefly responsible for developing OS/2, including a version called PM Lite that should run with 2MB of memory rather than 4MB. Other indications that IBM doesn't want to be exclusively dependent on Microsoft for operating environments include an alliance with Go Corp. to develop software for slate or tablet PCs. Patriot Partners, a joint venture with Metaphor Computer Systems, was also formed to create development software that would let the same applications run on OS/2, AIX, and Unix operating systems.

At year's end, Microsoft was prepar-

COVER STORY BEST OF 1990

ing a new release of DOS—Version 5—that would provide vastly more working space on PCs that have at least 1MB of system memory. By locating the bulk of DOS plus network and mouse drivers in memory above the 640K boundary, users

*The 16-MHz DX is
all but dead; the
20-MHz DX may
soon be, too.*

would have at least 620K free for their applications.

PC PLATFORMS

The plethora of processors and speeds may be due for a shakeout. Among the 80386SX, 80386DX and 80486 CPUs alone, there are currently eight performance levels ranging from the 16-MHz SX chip to the 33-MHz 80486—and still more when you factor in memory caches that boost the efficiency of the CPU in fetching data from memory. That's just too many performance levels that can't be perceived by the user. Look for a shakeout in processors during 1991. The 16-MHz DX is all but dead, and the 20-MHz DX may be headed in the same direction (see the sidebar "PCs 1990: The Year in Review").

Here's one scenario for PC platforms we'll see in 1991: the 10-MHz or 12-MHz 80286 for the most cost-constrained user, the 20-MHz SX (supplanting the 16-MHz SX), the 25-MHz 80386, and the 33-MHz 80386. Eventually, as chip yields increase, the 33-MHz 80486 will supplant the 25-MHz version. A 50-MHz 80486 is also on tap for 1991—with products anticipated

in the second half of the year—and Intel has announced that the 80586 will debut in 1992.

To increase the performance of your PC, you need more than a fast CPU. A quick hard disk (less than 25 milliseconds average access time) mated to a disk cache is crucial. If you're running *Windows*, a fast VGA or Super VGA card makes a substantial difference, especially if the

driver software was efficiently written. (Some of the first *Windows* drivers for Super VGA cards running at resolutions above 640 by 480 were remarkably inefficient.) And for most PCs bought today, 4MB of RAM should be included in the standard configuration, especially since the difference between 1MB and 4MB is generally just \$300 to \$500. Such a system—386 processor, Super VGA display, 4MB memory, fast hard disk—is the ideal configuration for a PC running DOS, *Windows*, or OS/2.

Not everyone wants ultimate performance, though. IBM surprised naysayers with the unexpected sales success of its home PC, the 10-MHz 80286-based PS/1. While there are clearly better values, the PS/1 delivers enough performance, value, and ease of use to avoid any danger of suffering the same fate as the PCjr.

DOWNSIZED PCs

Among traditional desktop PCs, which continue to represent the bulk of sales, small is in, too. An increasing number are little wider than the monitor, thanks to ongoing integration of components. The best-selling PCs are small-footprint units,

The Pocket LAN Adapters

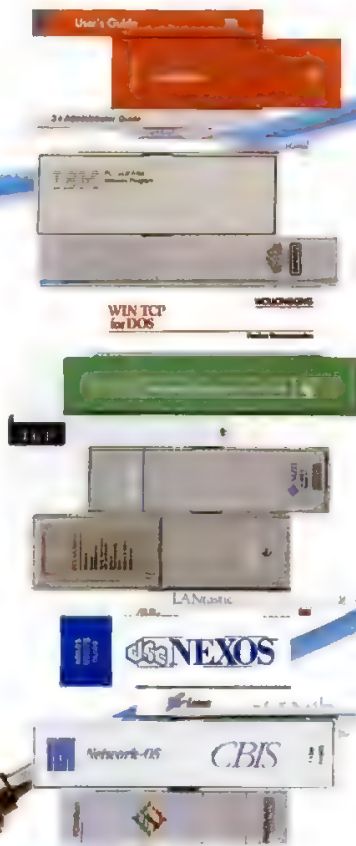
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including IBM's Model 50Z and Model 55SX, and Compaq's 386S.

The best-selling computers are also most likely to be SX-based units. In the past year, the 80386 SX chip has all but killed off the 80286 processor. In fact, Intel says that acceptance of the SX chip outstripped even Intel's most optimistic projections.

That's good news for Intel, which doesn't license fabrication rights to other chipmakers (except to IBM for IBM PCs only); bad news for the AMDs and Harries of the world, which have rights to build the increasingly irrelevant 286 but not the 386 or 486; and mixed news for customers, who'd just as soon have more than one source for the CPU. Intel's second-biggest customer, in fact, decided to do something about it. Compaq took a stake in NextGen, the start-up intent on creating a legal clone of the 80386, and is said to be considering non-Intel RISC (reduced instruction set computer) architectures for future high-end PCs. AMD also has plans to duplicate the 386. Third parties already produce duplicates of Intel's math coprocessors.

How small can PCs become? For diskless workstations connected to networks, it's technically possible to stuff all the electronics into the keyboard and monitor and do away with the system. If you need a floppy disk drive and a hard disk, the system unit need be little larger than a pizza box, a term you'll hear more of in the coming year. The odd unit out in the coming year will be the 22-inch widebody desktop unit with side-by-side drive bays, now that small-footprint PCs (typically 16 to 17 inches wide) offer equivalent expansion space. Users who want more storage turn to floor-standing tower units.

SERVICE AND SUPPORT

Is the era of free customer support drawing to a close? Software vendors are increasingly offering multiple levels of support, most of them for fees. The most recent support method is the 900 number that charges costs back to the user on either a per-call or per-minute basis. For

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business users for whom time spent waiting on hold is money down the drain, the promise of a speedy response is particularly enticing. Since most companies routinely block outbound 900 calls, one user per department or in the PC support group

The odd unit out in the coming year will be the 22-inch widebody desktop system with side-by-side drive bays.

needs to become a designated contact and have his or her phone exempted from the 900-block.

Direct or mail-order vendors of personal computers have also found that competent service and support is directly linked to their success. If the vendor can't resolve a problem over the phone, many of them will provide on-site service provided the product is still covered under warranty. A handful even offer around-the-clock phone support. In contrast, manufacturers of higher-end, higher-cost PCs contend that their machines are more likely to be in working order when they arrive and less likely to need service down the road.

Compaq, whose machines definitely fit into the higher-cost category, has continued to be a lightning rod for criticism by some users for its call-your-dealer policy that offers no direct assistance except to the largest sites. The users say that too much rests on the variable quality of Compaq dealers.

EMERGING STANDARDS

As the PC evolves, so too do standards, some formally codified by groups such as the IEEE or CCITT, some by manufacturers, and others by the sheer weight of user acceptance.

The 3.5-inch floppy disk, first brought to the PC by IBM in 1987 with the PS/2, may finally overshadow the 5.25-inch floppy by virtue of Compaq's decision at

midyear to make the first floppy disk drive in Compaq PCs the 3.5-inch drive, unless users specify otherwise. The standard capacity may jump from 1.44MB to 2.8MB, with the announcement of a new line of IBM PCs said to use the higher-capacity floppies. Over the next year, however, users would still do best to specify their PCs with both 3.5- and 5.25-inch floppy disk drives; a second drive adds only about \$100 to \$150 to the system cost.

Super VGA, the 800- by 600-pixel extension of 640 by 480 VGA, is almost de rigueur on all personal computers—except those made by the two market leaders, IBM and Compaq. Many vendors provide 1,024- by- 768-pixel super-Super VGA resolution as well, but it's noninterlaced and too hard on the eyes. To allow applications to run in multiple windows under *Microsoft Windows*, 16- and 17-inch monitors are gaining support over the currently standard 13- and 14-inch monitors.

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"NewWave's attractive icon-based interface eliminates the need to be concerned with the directory structures and file types of MS-DOS. A data file and the program code used to create, display, and print it are treated as a single object. To work with a file, you select the icon that represents both. To print the file, you move its icon on top of one that represents your printer."*
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—PC Magazine

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—Datapro

"Under NewWave, (Lotus) 1-2-3 gains a lot of features and functions it never even had under DOS, even though it's not a NewWave application."
—PC Week

"The icon-oriented NewWave 'office' resembles the Macintosh Finder but is much more capable."*
—PC/Computing



"Recognized by over 600 members of the Software Publisher's Association for Best Design Achievement and Best Business Application in 1989."
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"NewWave Write comes with a few bonus features that the other products don't have—for instance, it 'remembers' from the previous session which documents are still being worked on, and opens them automatically."
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"...NewWave is a splendid example of the kind of software innovation that is revolutionizing PC use."
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"You've heard it before, but this time it's for real. This is the year of the object. Hewlett-Packard's NewWave is going to be the fore-runner for a lot of exciting things for the 1990s."
—MIS Week

"The appearance and functionality of the NewWave environment replicate the legendary Macintosh ease of use to a greater degree than any other PC graphical user interface to date."
—Datapro

"Definitely the shape of things to come."
—Practical Computing



"Hewlett-Packard's NewWave is an exceptional advance in user interface design, rendering PC software dramatically more capable and simple to use. It also beats the pants off of the disappointing OS/2."*
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"Hewlett-Packard's NewWave is built on top of Microsoft Windows, and it bears a strong resemblance to the Macintosh desktop. It redefines how people should use software and how developers should build it."*
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"These are nice capabilities, but what makes the \$195 NewWave more than just another pretty interface is its ability to use these objects to contain or manipulate other objects."
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"NewWave's object management facility is its most powerful feature. The system treats a data file and the application that manipulates it as a single object. This enables users to invoke one application within another... NewWave's object management also lets users create hot links between objects to share and dynamically update data."
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"Not Just Another Pretty Interface. NewWave Redefines Software Use."
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"HP provides several levels of integration for DOS applications in the NewWave environment, ranging from running under the iconic desktop and swapping data via the Clipboard, to full compatibility."
—Practical Computing

"In addition to its object management features, NewWave overlays Microsoft Windows with a truly intuitive graphical front end, finally achieving Macintosh-like ease of use for the PC."
—Datapro

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[†]HP NewWave software requires Microsoft Windows 3.0 and an Intel 286 or 386 based PC with 640 Kb base and 2 Mb extended memory.

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COVER STORY
BEST OF 1990

Modems are evolving from offering no error correction or data compression as the standard to offering MNP 5, with CCITT V.42bis on the horizon. As the price of modem chip sets decreases, look for more modems to bundle in fax capability. PC-based fax devices won't take off, however, until they become markedly less complicated to use; ideally the user should be able to choose the fax board as a print device from within any applica-

tion. Intel fax boards with CAS (Communicating Applications Specification) came closest to the ideal, but were too pricey until the advent of the company's Satisfaxtion board, which sells for about \$400 with a 2,400-bps modem built in. Even then, you're still best off using a fax board as a send-only device. Faxes are far easier to receive on fax machines.

Tests by PC Labs indicate that there's still plenty of life left in the classic AT bus.

Also clouded is the issue of a PC bus standard. Tests by PC Labs indicate that there's still plenty of life left in the classic AT bus, especially on standalone PCs and workstations. EISA and Micro Channel buses may have more performance potential, but it needs to be tapped by bus-mastering cards, multiple processors on file servers, advanced network operating software, and multiple drive arrays. The single best-selling brand of PC remains IBM, but the market for IBM Micro Channel-compatible PCs has been virtually nil except in the U.S. Most PCs using an extended bus architecture are EISA systems.

A dual standard is evolving among

laser printers. Most printers sold today are HP PCL-compatible, especially since Hewlett-Packard alone accounts for about half the market. The cost increment of PostScript and PostScript-compatible printers has dropped from more than \$1,000 to as little as \$500 in some cases.

PERSONAL BESTS OF 1990

On the following pages, you'll read about the best products of 1990. These 32 products—rated Editors' Personal Best by *PC Magazine's* editors and contributing editors—represent the software and hardware offerings that they personally consider the year's best and most useful.

It's important to distinguish the Editors' Personal Best products from the Editor's Choice designation and the Technical Excellence Award products. The Editor's Choice designation is determined by a board of editors and contributing editors on the basis of comparative benchmark testing of hardware and software in

PC Labs. Of course, the 1990 Technical Excellence Award winners and finalists are also among the best offerings we've seen this year (you can read about them in this issue's cover story on *PC Magazine's* 7th Annual Awards for Technical Excellence), but they are nominated and voted on by a board of *PC Magazine* editors and PC Labs staff.

Editors' Personal Best selections reflect the skilled but individual assertion of a *PC Magazine* editor or contributing editor. Many Personal Best products also have received the Editor's Choice designation; however, the two are clearly different. Occasionally, you'll see vendors attempt to shorten the designation in their advertising to something like "*PC Magazine* Best of 1990," which is inaccurate because it suggests a blanket endorsement from *PC Magazine*.

Products on the market by fall 1990 were eligible for nomination as Editors' Personal Bests. We filtered out those that received Editors' Personal Best commendations last year and remained substantially unchanged. Personal Best products are presented in alphabetical order, by company name for hardware, by product name for software. A complete list of the Editors' Personal Best selections appears in the table of contents.

THE BEST OF 1990 CONTRIBUTORS

PC Magazine editors:

Julie Cohen, Frank J. Derfler, Jr.,
Lori Grunin, Bill Howard, Carol Levin,
Bill Machrone, Jonathan Matzkin,
Rock Miller, Matthew J. Ross,
Tom Unger, Gus Venditto,
Don Willmott, Jennifer Zaino.

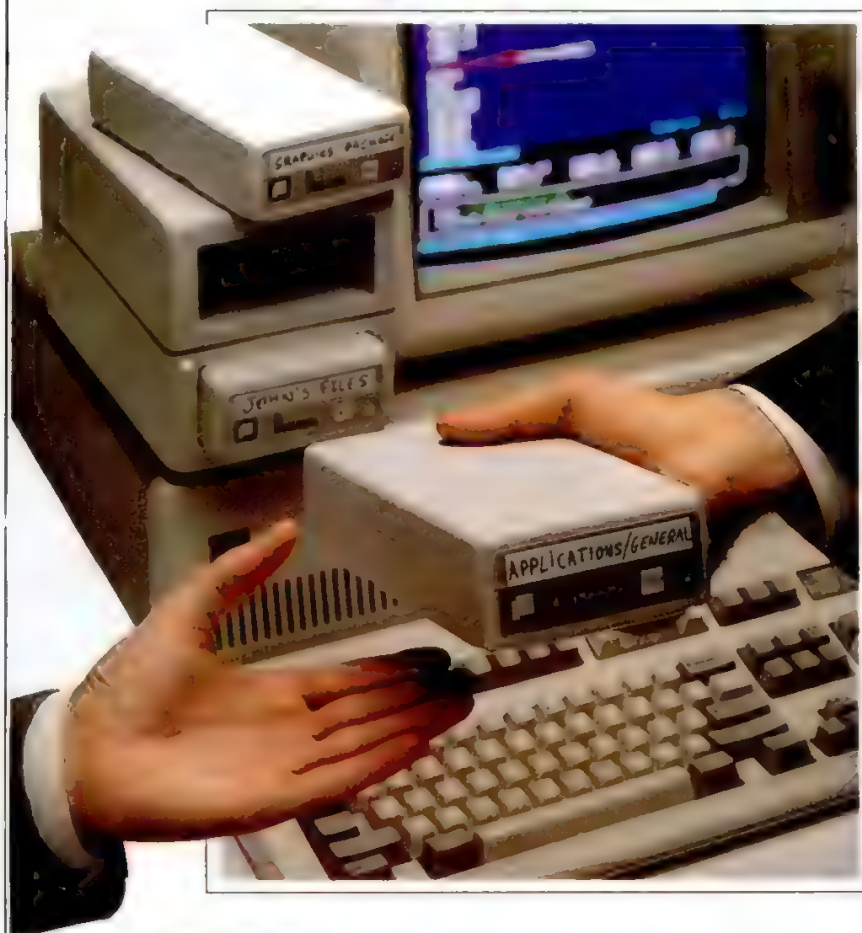
Contributing editors:

Douglas Boling, John C. Dvorak,
Edward Mendelson, Charles Petzold,
Alfred Poor, Jim Seymour,
Richard Hale Shaw, Barry Simon,
Luisa Simone, Craig Stinson,
Ethan Winer.

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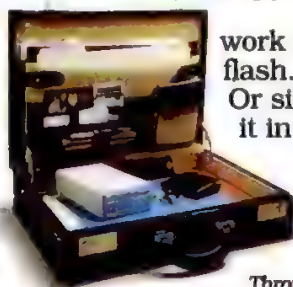
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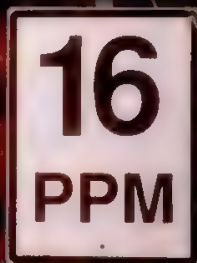
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Samna Corp.

Amí Professional, Version 1.2

by Edward Mendelson

Amí Professional can't actually write your documents for you, but it can do almost everything else. Samna Corp.'s \$495 Windows-based word processor can process graphs, tables, drawings, and gray-scale images as effectively as it processes words.

The menus in *Amí Professional* give you one-stop control over format and page layout, and you don't even need a menu to create a header—you simply move the cursor onto the border of the page and start typing. Similarly, when you create a footnote, the cursor jumps to the bottom of the page and waits for you to type. If you don't know the command that accomplishes a formatting or editing task in *Amí Professional*, simply try the method that you wish other programs would use—it probably works.

Amí Professional is easy to use—so easy that you can deceive yourself into thinking that it's less powerful than it really is. If you want to insert a graph in your document, for example, you can either simply type in your data as you would on a typewriter, or create a Dynamic Data Exchange link with an *Excel* spreadsheet. *Amí Professional* lets you choose from more than 50 graphing options, including 3-D effects. If you don't like the location of the labels on the graph, you can take the whole graph apart and reassemble it using *Amí Professional*'s built-in drawing tools.

If you want to use a scanned gray-scale image, you won't need an expensive image editor to get it to look decent. *Amí Professional* has built-in controls for modifying TIFF images for improved contrast and enhanced edges. And although *Amí Professional* can never replace your spreadsheet, its tables incorporate the arithmetic functions that you use most.

Amí Professional's \$199 little brother, *Amí*, lets you edit, display, and print any file created by *Amí Professional*. While *Amí Professional* lacks the industrial-strength text-processing functions of *Word for Windows*, no other Windows application lets you create so many elements in a

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document with so little work. Powerful as it is, *Amí* is as amicable as its name implies.

FACT FILE

Amí Professional, Version 1.2; Samna Corp., 5600 Glenridge Dr., #300, Atlanta, GA 30342-1334; (404) 851-0007.

List Price: \$495. **Requires:** 640K RAM, hard disk, DOS 3.0 or later, 80286 or better PC, Windows 3.0. Mouse recommended. **Reviewed:** December 11, 1990, page 110.

CIRCLE 419 ON READER SERVICE CARD

Dynaware USA Inc.

Ballade, Version 2.0

by Bill Machrone

You can buy a more powerful sequencer, and other notation programs are far more flexible. But nothing puts it all together for the home MIDI musician better than *Ballade* 2.0 from Dynaware USA.

The \$195 program records the notes you've played and displays them in sheet music form, which is far superior to the piano-roll displays used by most sequencers. You can edit what you've played with a mouse, changing the tempo and volume of each note as you go. *Ballade* records and plays back as many as ten musical tracks or instruments at once—a pittance in terms of what professional sequencing software can do but realistic in terms of what your synthesizer can play. It gives you perfect control over the volume and stereo placement of each instrument, and it lets you select instruments from your synthesizer interactively.

Ballade compensates for your musical deficiencies, letting you play off-tempo, even a note at a time, and puts everything into place. You can quantize selectively, putting the accompaniment on a rock-solid beat, while you take liberties with your melody line. The graphical control screens are knockouts, both in appearance and function.

Ballade is highly attuned to the Roland MT-32, CM-32L, and LAPC-I—good choices because these synthesizers are inexpensive and widely used. However,



Amí Professional



Ballade

I'd like to see templates for other synthesizers and keyboards, too.

There's a home music revolution in the offing, and programs such as *Ballade* are helping to make it.

FACT FILE

Ballade, Version 2.0; Dynaware USA Inc., 950 Tower Lane, #1150, Foster City, CA 94404; (800) 445-3962, (415) 349-5700.

List Price: \$195. **Requires:** 640K RAM, EGA or VGA graphics card, MIDI interface card, mouse. **Supported sound modules:** Roland MT-32, CM-32L, LAPC-I. **Supported printers:** IBM Proprinter, Epson, and Toshiba 24-pin dot matrix. **Reviewed:** November 13, 1990, page 609 (Version 1.6).

CIRCLE 420 ON READER SERVICE CARD

California Scientific Software

BrainMaker Professional, Version 1.5

by John C. Dvorak

Every decade or so some peculiar application shows up that is so futuristic you have to wonder whether it's for real. *BrainMaker Professional 1.5* (\$795 from California Scientific Software) is one such program.

BrainMaker Professional is a 100 percent software implementation of a neural network (the original implementation of the neural network, the \$195 *BrainMaker*, is still available). Neural nets are designed to be pure pattern-recognition machines best used to discover hard-to-find patterns within a data stream. For example, harness racing data can be fed into the spreadsheet front end of *BrainMaker Professional* and the program can "learn" to find coincident data patterns that indicate a winning horse.

The idea of a neural network is to set up within a computer a set of bogus neurons crudely based on the synapse mechanism of the mammalian nervous system. A pattern is presented (from a scanner or from data files) to the network; the pattern causes a series of neurons to "fire," creating a pattern within the network. If, for example, the network is trying to do optical character recognition, then it might be shown an "A" and told that it is an "A." When shown an "A" again, it makes a guess as to what it is. Through a feedback

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mechanism, the network is continually told what guesses are right and wrong until the feedback mechanism is no longer needed and the network is ready to guess the answers by itself—here, spotting an "A" among a character set.

But in today's world of neural networks, OCR work is trivial. With *BrainMaker Professional*, you can feed in data from all the football games played this year, as well as the final scores. By the end of the season, the program should be able to guess the scores based on pregame data. At least, that's the hope of all the football bettors out there. Of course, the gambling houses will probably use *BrainMaker*, too, so expect to tie the house a lot.

Whatever you use *BrainMaker Professional* for—validating stock selections, picking a horse, or anything else—this is the kind of software that makes computers exciting.

FACT FILE

BrainMaker Professional, Version 1.5; California Scientific Software, 10141 Evening Star Dr., #6, Grass Valley, CA 95945; (800) 284-8112, (916) 477-7481.

List Price: \$795. **Requires:** 512K RAM, DOS 3.0 or later. Hard disk recommended. **Reviewed:** February 14, 1989, page 56.

CIRCLE 421 ON READER SERVICE CARD

Nu-Mega Technologies Inc.

Bounds-Checker, Version 1.1

by Salvatore P. Ricciardi

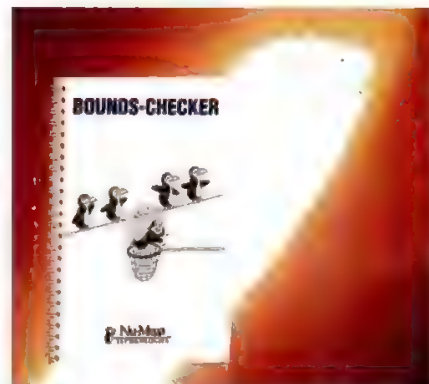
The 80386 and 80486 processors have spawned a number of programs dedicated to making use of their superior capabilities. If you're a programmer, the \$249 *Bounds-Checker* may prove to be the one dearest to your heart.

Bounds-Checker helps you find memory overwrites—bugs in your code that cause your program to access areas in memory that it's not supposed to. It will also let you know when outside programs, such as TSRs, are accessing areas of memory owned by your program.

When an out-of-bounds memory ac-



BrainMaker Professional



Bounds-Checker

Peter Norton's
Philosophy
On Data Recovery
Can Be
Summed Up
In Three
Little Words:

Never



Peter Norton

When it comes to your crucial data, Peter Norton just won't take **C>FILE NOT FOUND** for an answer. With programs like the Mace Utilities[®] and PC Tools[®], data recovery is often mission impossible. But with the Norton Utilities[®] 5.0, data recovery is mission *critical*—and it can recover what no other utility can.

Data Recovery is serious business, which requires serious features. And the Norton Utilities has them all.

Norton Does Windows.

The Norton Utilities is *the* safe DOS utility program for use with windowing environments like Windows[®] 3.0 and DesqView.

Because PC Tools and Mace Utilities are blind to multi-tasking, they can irreversibly damage your files. While the Norton Utilities 5.0 offers three full levels of safety checks under Windows 3.0.



With a clear vision of the PC's future, the Norton Utilities 5.0 provides safe Windows 3.0 recovery.

Norton On Networks.

The Norton Utilities is the *only* utility program that provides Novell and DOS-compatible network recovery. So you can use *UnErase[®]* to recover deleted files, or *File Fix[™]* to reconstruct Lotus[®] 1-2-3[®] and dBASE[®] files. From any node on the network.

What's more, MIS will appreciate the Norton Utilities' compliance with existing network security restrictions.

System Information provides detailed reports on network information and TSR memory allocation, as well as graphical benchmarks of disk, CPU, network, and general computer performance.

The next best thing to being there is being on the network. And the Norton Utilities 5.0 is the only data recovery tool that is.



DATA RECOVERY FEATURES	NORTON UTILITIES	PC TOOLS	MACE 1990
Number of DOS Error Messages With On-Line Advice	75	0	0
Different Types Of Data Loss Problems Solved			
File System Corruption	31	12	15
Physical Hard Disk Damage	6	0	0
Internal Data File Damage (i.e. dBASE, Lotus)	10	0	6
Disk Reliability Testing (Number Of Patterns)	80	0	0
System Information (Topics Reported)	94	15	16
NETWORK recovery	YES	NO	NO
WINDOWS Safe Operation	YES	NO	NO
Failsafe Design	YES	NO	NO
Effective File Encryption That Does Not Require You To Change The Way You Work	YES	NO	NO

Say Die.

Norton's Superior Recovery Technology.

The Norton Utilities handles the toughest data recovery situations easily—predicaments other utilities handle poorly, if at all.

Advise explains cryptic DOS error messages in plain English so you can understand the problem, and gives specific recommendations on how to fix it. So your valuable data is not at the mercy of risky trial-and-error procedures.

Unlike the competition, Norton recovery procedures are easy to use and completely failsafe. And because you can UNDO changes, you won't make a bad situation worse. In fact, while using the Norton Utilities your data will even survive a sudden power loss. All in all, it's the safest, most extensive diagnostic and recovery utility available.

And only the Norton Utilities gives you every-

Norton Utilities 5.0 Adds Features, Improves Interface

"Norton's disk utilities now surpass anything you can find in PC Tools Deluxe or The Mace Utilities, and offer safeguards you can't find anywhere else."
— PC Magazine 10/16/90

Don't just take our word for it, the proof is in the press.

thing you need for optimal system performance.

The new *Norton*

Cache and the improved *Speed Disk*™ make your hard drive faster and more efficient. And *Calibrate*™, which outperforms *SpinRite*™, adjusts the interleave, identifies bad sectors, and even repairs demagnetized

areas of your drive.

So get serious about data recovery. See your dealer for the new Norton Utilities 5.0 and get a free+ copy of the Norton Backup™ with purchase. To upgrade now call **1-800-343-4714** or fill out the coupon below. For more information, call **1-800-365-1010 Ext. 708** (in Canada, 1-800-465-2266). And in the immortal words of Peter Norton, "Never say die."

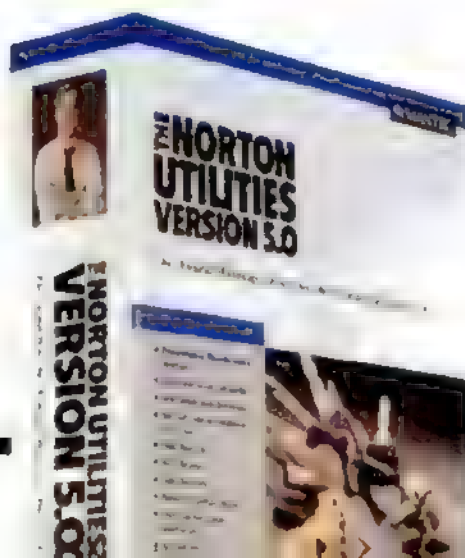
SYMANTEC.

\$59

Upgrade Now and Save \$269!

Mace Utilities and PC Tools users can now get the Norton Utilities 5.0—list price **\$179**—for **\$59**. Which also includes a coupon for a *free*+ copy of the Norton Backup*—list price **\$149**! Just send this coupon to Symantec, along with the title page from your Mace Utilities or PC Tools product manual. Send a check or have us bill your VISA or MasterCard \$59 plus tax and \$5 shipping and handling.

*Backup Offer expires January 31, 1991. Norton Utilities 5.0 offer expires February 28, 1991. Valid in U.S. and Canada only. Please allow 4-6 weeks for delivery. Only one upgrade per coupon. For multiple upgrades or POs, call 1-800-441-7234. For Canadian orders, call 1-800-465-2266.



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Company name _____
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☐ Check enclosed ☐ VISA ☐ MasterCard
All payments must be made in US dollars drawn on a US bank.
Name as it appears on your card (please print) _____
Acct. No. _____
Exp. Date ____/____/____ Day phone (____) _____

Quantity	Disk Size	Unit Cost
One	☐ 5 1/4-inch ☐ 3 1/2-inch	\$59.00
In these states, add sales tax including applicable local tax: CO 3%; GA, IA, MI, NY 4%; MO 4.225%; IN, MD, MA, OH, WI 5%; DC, FL, MN, PA 6%; CA, IL, TX 6.25%; WA 6.5%; NJ 7%; CT 8%.		
Add shipping and handling:		\$ 5.00
Total:		

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Attn. "Never Say Die" Offer • P.O. Box 161690
Cupertino, CA 95016-1690

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+ \$10 shipping and handling fee.

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UNDERSTANDING 1990, OR TRUTH IS STRANGER THAN FICTION

by Jim Seymour

This was a strange year. Novell and 3Com cuddled up; Novell and Lotus broke up. Microsoft and IBM's on-again, off-again relationship turned into off-again, off-again, off-again, don't-call-us-we'll-call-you, and so there, Mr. Bill. The nation's judicial system showed how little it understands the computer business; the nation's legal system showed how little it understands people who use computers. And IBM got something right.

Strange, eh?



A 386-specific version of OS/2 seemed a tantalizing possibility early in the year, as Microsoft finally shipped the OS/2 2.2 System Developers' Kit (SDK). Unfortunately, while the 486 came to prominence this year, 386 OS/2 remained only a possibility; it was nowhere to be seen.



Ashton-Tate finally shipped *dBASE IV*, Version 1.1, which was as good as we'd hoped it would be. The question now: Does it still matter?



Hewlett-Packard retained its market leadership with the dazzling LaserJet III. Its impressive performance and aggressive pricing warmed the hearts of customers. And its impressive performance and aggressive pricing scared the hell out of HP's competitors.



Compaq and Businessland got back together again. Just in time for Businessland's slide. Ho-hum.



In one of the year's smartest financial deals, Symantec bought Peter Norton Comput-

ing in an all-stock deal. Norton got to go public without all those messy questions about its management; Symantec got a good but ragged product line and a gold-plated name. Win-win. Now let's see some *Windows* products, huh?



If you thought annual forecasts of the impending "Year of the LAN" were tedious, you'll love Apple's annual "Year of the Reorganization" theme. In this year's desk-swap, good people left, good people arrived, and good people changed jobs. All with no discernible impact on Apple's continuing decline from importance to immateriality in the personal computer business.



Canada's ATI shipped its revolutionary VGA Basic-16 display card in late summer. Performance was only stock-VGA, but both the form-factor and price were stunning: the tiny card lists for a mere \$99.



Delays on OS/2 notwithstanding, Microsoft had a very good year. *Windows 3.0* proved to be almost as big a hit as Microsoft's PR machine predicted. *PowerPoint* and *Project for Windows* were knockouts; *Windows Word* looks like the standard, for a while, in graphical word processors; and DOS 5.0, due to have shipped by the time you read this, was set to surprise us all by showing how well Microsoft listens. Microsoft? *Listens?*



How do you spell "allocation"? I-N-T-E-L. Having muscled the 80386 to dominance in the PC hardware business, Intel then found it couldn't produce the chips in anything like the quantity needed to satisfy customers. Some grumbled darkly

that this is what happens when you have an artificial monopoly; others looked hopefully toward Compaq's pet, NewGen, for relief in 1991.



Borland introduced a hot new version—3.5—of *Paradox*, and a sensational new *Quattro Pro 2.0*. Okay, Philippe, objects are in. But aren't you getting a little tired of playing Avis to the Hertz in each of your markets? What's the new Borland application that's going to take over a market the way you did with *Turbo Pascal* and *Turbo C++*?



Novell and Lotus skipped the dating stage and went straight to living together. Unfortunately, by the time the two companies found they *couldn't* live together, the wedding announcements were already in the guests' hands. Ray Noorda looked like a dope, Jim Manzi actually looked good, and the guests breathed a lot easier.



Canada strikes again: *PerFORM Pro* shipped in September, giving *F3* and the other new high-end forms-design packages a run for their money. Delrina, the company behind *PerFORM*, also sold a piece of itself to IBM, which, as Bill Gates could tell it, can lead to an interesting life.



Compaq sold few of its innovative Systempros (universal nickname: the Systemslo) this year. Its incredibly high prices for drive arrays and memory (so what else is new, Rod?) probably had something to do with that.



Judges had a mixed year. One misunderstood the issues in the *Lotus v. Paperback Software*

CONTINUES

UNDERSTANDING 1990

CONTINUED

case, reaching the right decision for the wrong reasons. Another thought Robert Morris deserved only a slap on the wrist for his massive infection of the Internet system. But a judge in England found for tiny Madge Networks over Olof Soderbloom, the guy to whom American computer companies (IBM at the head of the line) have meekly paid something like \$25 million for licenses to what he says was his idea: token-passing rings.



Unfortunately, the same week Madge Networks won its big victory—a victory for everyone in the networking industry (except Olof and his backers)—Madge also recalled its trend-setting 16-megabit-per-second token-ring adapter cards. The blame wasn't Madge's, but belongs to Texas Instruments, whose Falcon 16-megabit-per-second chip set, upon which nearly every network vendor has been relying, is fundamentally flawed.



The U.S. Patent Office found that Californian Gilbert Hyatt had a legitimate claim to some critical microprocessor patents. Go, Gil! Now just don't get too greedy. . . .



So IBM did some dumb things. Its 386SX network server showed it hasn't lost its whimsical touch, but wait, there's more: Blue also looked silly by going almost a whole year with nary a 486 product but the wimpy 486/25 Power Platform plug-in card for PS/2 Model 70s; by rolling out the ludicrous PS/1; by shipping a low-end laser printer artificially slowed by a wait-state added to its memory; and by recalling zillions of defective el cheapo power cords from Mexico that it had shipped with Model 55s. *Plus ça change*. . . .



Those Southern boys just keep on a-comin'. Mobile, Alabama—based QMS keeps challenging HP and Apple head-to-head in the printer market, often winning on points in split decisions. This year the company scored a clear knockout with its PS-410, the best implementation yet of Canon's LBP-LX engine. And QMS put in an automatic datastream switcher that allows simultaneous connection to parallel, serial, and AppleTalk machines. With that kind of grits power, the South may indeed rise again.



Okay, so it looks like a chubby PS/2 Model 50. Forget appearances: IBM's PowerStation 320 is one of the slickest Unix workstations on the market. If IBM can build 'em fast enough (the 320's 1990 production was sold out for the year not long after it was introduced) and cut prices fast enough (Sun is running right at IBM with its new, even-cheaper SPARCstations), IBM will have an unquestioned winner. In a major supporting role: AIX 3.1, not only a *good* Unix, but a vastly improved product over the lame duck of the same name that appeared with the RT PC. Almost all is forgiven, IBM—but could you move some of those System/6000 guys over to your PC operations. . . . ?



Make that three for the guys from the North: Ottawa may be the dullest place in North America, but it sure hasn't dulled the minds of the people at Corel. This year they rolled out a great new version of what is not only the best and easiest-to-use illustration program for *Windows* users, but also threw in for free the best PC autotracing program ever developed. Lots of fonts, semi-good (which means better than the competition's) clip art, and a will-

ingness to keep upgrading *Draw* kept Corel on top.



The soap opera continues. Will *Improv* and *PowerStep*, the best spreadsheets no one's ever going to see, be enough to save NeXT? Will color be enough? Will cheaper but uglier monochrome machines be enough? Will cash from Canon and Ross Perot (what a duo!) be enough? Will adding a floppy disk drive be enough? Tune in tomorrow and see if anybody you know remembers the glorious but somnambulant NeXT machines, from the vainglorious but somnambulant NeXT Inc.



Okay, so it was frozen out of the rich 80386 market. But AMD decided the 20 million-plus 80286 machines out there were too rich a market to ignore. So it came up with a direct-marketed \$99 80287 math chip. Despite some foul-ups on two-fer deals that didn't work the way buyers expected, AMD had a modest success. What's up next, Jerry? Are you serious about an unauthorized 80386? How about a \$99 80387?



Sun took its licks on the 386i, the company's first effort to build a sort-of DOS box. In just a year and a half, the machine fell from hot-new-product status to an \$800 special at Sun's garage sale this summer. Now Scott McNealy and the Sun boys are trying again: The SPARCstation IPC (McNealy: "The name means 'Isn't a PC'") appeared this year, and it looks like a very good bet for those users who run mainly technical and scientific Unix applications but can't stand the doggy business-productivity applications (word processing, spreadsheets, and so forth) available under Unix.

cess occurs, *Bounds-Checker* flags it immediately and pops up a screen display pinpointing the line in your program that caused the problem. Since some accesses

Bounds-Checker *intelligently uses* **386 and 486 page** *management features* **to make software** *development easier.*

may be acceptable, such as writing directly to video memory, you can add the occurrence to an exception file that lists these "valid" accesses.

You can maintain a log of all invalid accesses and you can write-protect memory areas, since *Bounds-Checker* pops up before the errant operation actually occurs. The program is smart enough not to pop up during DOS or BIOS calls, unless DOS or the BIOS itself is doing something strange to your code area.

Bounds-Checker performs its magic by using the page management features built into the 80386 and 80486 processors. It builds a page map for memory, marking those pages that don't belong to your program as read- and write-protected. It then marks all pages that span your code as write-protected and allows your program free access to memory areas it owns or allocates. When your program is run, the 80386 or 80486, courtesy of its page-protection features, notifies *Bounds-Checker* when page accesses violate the read/write-protection mechanism.

Memory overwrite problems have plagued DOS programmers since the PC's inception. *Bounds-Checker* makes intelligent use of the 386 and 486 to make your job easier. If you're developing DOS



Calera WordScan Plus

software on a 286, *Bounds-Checker* is your reason to upgrade.

FACT FILE

Bounds-Checker, Version 1.1; Nu-Mega Technologies Inc., P.O. Box 7780, Nashua, NH 03060-7780; (603) 888-2386.

List Price: \$249. **Requires:** 256K extended memory, 8K conventional memory, DOS 2.0 or later, 80386SX or better PC. **Reviewed:** July 1990, page 48.

CIRCLE 422 ON READER SERVICE CARD

Calera Recognition Systems Inc.

Calera WordScan Plus

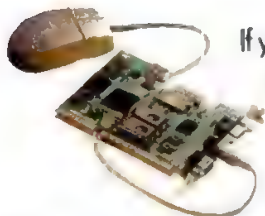
by Lori Grunin

A picture is worth a thousand words, but what do you do with a picture of a thousand words? Run it through a scanner and feed it to *Calera WordScan Plus*—Calera's contribution to optical character recognition on the PC.

Calera WordScan Plus offers the recognition capabilities of its coprocessor-board-based predecessors combined with a flexible, easy-to-use, and imaginative feature set. While *OmniPage/386* was the first PC product to allow you to run software-only page decomposition and OCR, the \$995 *WordScan Plus* goes it several better. It adds the capability to run on an 80286-based machine; offers support for



VGA WONDER+ FASTER THAN VRAM



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While others follow, VGA WONDER+ leads the flock with remarkable resolution, fabulous colors and outstanding value. VGA WONDER+ offers an optimized architecture including fast 16-bit bus support and fast page mode memory which assures maximum speed...that's faster than VRAM and other VGA cards. Based on ATI's

original award-winning VGA WONDER* and available in 256K and 512K versions, you receive:

- High resolution non-interlaced and interlaced 1024x768 plus 800x600 graphics;
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- Ergonomic 70Hz refresh rate in 1024x768, 800x600 and 640x480;
- Easy, switchless installation;
- Free Microsoft* compatible bus mouse;
- And much more.

With VGA WONDER+, performance is in the baaaaaaag.

For more information, contact your supplier or

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1990
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Sharp Electronics Corp



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4.4 lbs.



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With a speedy
23ms access time.

THE PC-6220.

About the only thing you *don't* get with the Sharp PC-6220 is another piece of luggage to carry. It's a mere 8½" x 11" and weighs only 4.4 lbs., yet has the kind of power you need. To run Windows™. To do desktop publishing. To have instant access to your programs and files.

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batch processing of *multiple* documents (not just multiple-page documents)—double-sided as well as single; and includes the Pop-Up Verifier, a speedup, clean-up text editor that helps you quickly locate unrecognized characters via embedded codes and correct them by referring to their pop-up bitmaps.

The package doesn't force you to scan your document in any particular orientation—if upside down and backwards is your preference, *WordScan Plus* can handle it. Also, in addition to preserving the font and style information of the input document, the package's style sheets let you override these attributes when saving.

While not the most fleet-of-foot among OCR packages, *WordScan Plus* hardly stands choking on dust at the starting line. Its flaws, such as a rather rigid policy on output file extensions, are pretty trivial in light of its power. *WordScan Plus* doesn't come cheap, but the budget-conscious can forgo a few features (such as the Pop-Up Verifier and style sheets) and opt for the program's powered-down \$595 sibling, *WordScan*.

FACT FILE

Calera WordScan Plus; Calera Recognition Systems Inc., 2500 Augustine Dr., Santa Clara, CA 95054; (800) 544-7051, (408) 986-806.
List Price: \$995. **Requires:** 2MB RAM, DOS 3.1 or later, *Microsoft Windows* 3.0, 6MB hard disk space, 80286-based system or better, compatible scanner. An 80386 PC or better and 4MB RAM recommended. **Reviewed:** October 30, 1990, page 354.

CIRCLE 423 ON READER SERVICE CARD

ManageWare

Compete! Modeler, Version 4.0

by Craig Stinson

How many spreadsheet files does it take to analyze five years' worth of actual and projected financial data for seven product lines sold in four territories via three channels of distribution? Just one, if your spreadsheet program is ManageWare's *Compete! Modeler* 4.0, available for \$4,995 in its 12-dimension version.

Compete!, whose one drawback is its copy protection via a hardware key, brings spreadsheet simplicity to multidimen-

COVER STORY BEST OF 1990

sional modeling in a way that's never been done before. You can track up to 12 dimensions (products, time periods, financials, regions, actuals, budgets, and competitors' performance, among others) at once. Of course, the underpinning of your model is not a traditional spreadsheet, but something akin to a database. However, *Compete!* lets you work with any two-dimensional slice of your data in a format that's almost exactly like a standard spreadsheet.

Compete!'s presentation is a lot like *Microsoft Excel*'s. ManageWare struck a licensing deal with Microsoft that allowed it to copy the user interface of the market's most popular graphical spreadsheet. *Compete!*'s menus look like *Excel*'s; its functions are close kin to *Excel*'s; and its rows, columns, and windows can also be manipulated directly with the mouse.

What's novel and brilliant is the way *Compete!* extends the notion of direct manipulation to reduce the complexity of multidimensional analysis. While you look at your two-dimensional slice in row-and-column format, the remaining dimensions of your model are represented by buttons arrayed across the top of the grid. To change perspective, you can either click an arrow next to a dimension's button (bringing a different object along that dimension into view) or drag the button onto the row or column headings of your grid. With simple clicks and drags, you can instantly produce whatever cross-dimensional slice you need.

Anyone not yet convinced that graphical environments can simplify conceptually tough computing tasks ought to take a look at *Compete! Modeler* 4.0.

FACT FILE

Compete! Modeler, Version 4.0; ManageWare, 100 First Stamford Place, Stamford, CT 06902; (203) 359-9397.

List Price: Four-dimension version, \$995; 12-dimension version, \$4,995. **Requires:** 640K RAM (2MB recommended), *Windows* 3.0 or later, mouse. Copy protected via hardware key.

Reviewed: November 27, 1990, page 43.

CIRCLE 424 ON READER SERVICE CARD



Compete! Modeler

Ashton-Tate Corp.

Control Room

by Julie Cohen

With one \$129 program, it's now possible to analyze your system, search for viruses, handle filing chores, set up keyboard macros, and perform other functions that formerly required various TSRs to accomplish. That program is Ashton-Tate's *Control Room*, a product that features such clear on-line help and such a well-designed visual layout that it's a joy to use.

Control Room creates a customized TSR to configure your system with any of the functions you choose from a series of menus. Change system configuration settings, set screen blanking, cycle back through previous DOS commands, or scan for viruses. Depending on the number of functions you choose to select, the TSR can take up anywhere from 5K of memory to 20K.

The program also offers hotkeys that let you do such things as paste the time and date into your applications. The keyboard menu also gives you access to creating your own macros. A disk cache can be installed in conventional, expanded, or extended memory.

Not all functions are available from the TSR. Run the configuration program from the DOS command line and you have access to the Task option, from which you can delete and undelete directories, encrypt and decrypt files, or create a backup CMOS disk. (*Control Room* isn't a replacement for *The Norton Utilities* or programs of that ilk, however.) These features—in addition to *Control Room*'s ability to maintain an inventory of applications and otherwise supply detailed statistical reporting information—make the program useful for LAN administrators who control data security. In fact, *Control Room* received an honorable mention in our LAN statistical reporting software review, "Building Workgroup Solutions: LAN Statistics Software" (October 30, 1990).

If you'd like to get rid of standalone utilities in favor of a single, automatically installed program that will also provide



you with lots of statistical data about your PC, *Control Room* is the way to do it.

FACT FILE

Control Room: Ashton-Tate Corp., 20101 Hamilton Ave., Torrance, CA 90509-9972; (213) 329-8000.

List Price: \$129. **Requires:** 384K RAM, DOS 3.0 or later. **Reviewed:** October 30, 1990, page 212.

CIRCLE 425 ON READER SERVICE CARD

DataEase International Inc.

DataEase SQL

by Joe Salemi

Take an Editor's Choice-winning database system that is known for its ease of use, give it the ability to be a front end for a SQL Database Server, and what do you have? DataEase International's *DataEase SQL*, the first major update for *DataEase* in almost two years.

DataEase SQL (\$995 for the *Professional* developers' version) does a good job of transparently integrating SQL server access into the familiar *DataEase* environment. *DataEase 4.2* users will see little difference in the new version; the menus and function keys are the same, and the interface remains forms-oriented. Where the data with which a form is associated resides is specified once; from that point on, the links to the data are made without user intervention.

The secret behind this is a *DataEase* facility called PRISM—the Processing Router for Integrated SQL Management. PRISM converts the *DataEase* functions and DQL (DataEase Query Language) statements into optimized SQL statements, then transmits them to the SQL Server. Native SQL statements can also be included in a *DataEase* application.

PRISM uses the capabilities of the database server's native SQL language in true client/server fashion, properly off-loading as much of the processing as possible to the database engine. While many variables can affect performance, users of *DataEase SQL* will find that the response to many functions is almost in-



Control Room



DataEase SQL

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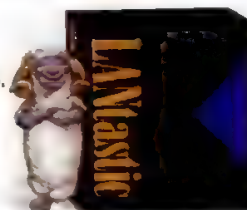
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ultimately means they get
their products to the world
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modem options. Just to name a few.

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ARTISOFT

CIRCLE 254 ON READER SERVICE CARD

*Based on manufacturer's suggested retail price for a 10-computer LAN using LANtastic 2Mbps adapters. Cost is slightly higher for smaller networks. ©1990 ARTISOFT LANtastic is a trademark of Artisoft.

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stantaneous, since *DataEase* has only to transmit the appropriate SQL statements to the server.

Both DOS and OS/2 character-mode versions of *DataEase SQL* are available. The initial release supports the *Microsoft/Sybase SQL Server* 1.1, as well as the native *DataEase* database format; support for other SQL servers (mini- and mainframe, as well as PC-based) is planned for future versions. Multiple database engines can be accessed from the same application, making *DataEase SQL* a powerful tool for integrating data from the variety of databases that most businesses have.

The client/server architecture in general, and SQL database servers in particular, will grow in importance during the coming years. *DataEase SQL* sets a high standard for the vendors of other SQL front ends to match.

FACT FILE

DataEase SQL; DataEase International Inc., Seven Cambridge Dr., Trumbull, CT 06611; (203) 374-8000.

List Price: *Professional* (developers' version), \$995; *Workstation Master*, \$1,500; five-user *Workstation Pack*, \$1,750; *Application Developers Kit* (includes *Microsoft SQL Server* and three copies of *Professional*), \$5,995.

Requires: 2MB extended RAM, DOS 3.1 or later or 4MB extended memory, OS/2 1.1 or later, 80286 or better PC, *Microsoft SQL Server* 1.1 or later, *LAN Manager* 2.0 or later, 3+Open 1.1 or later, *Novell NetWare* 2.1 or later with NetWare Requestor for DOS or OS/2. **Reviewed:** November 13, 1990, page 33.

CIRCLE 426 ON READER SERVICE CARD

Xerox Imaging Systems Inc.

Gray F/X, Version 1.1

by Alfred Poor

Today you can produce quality gray-scale images on PCs and even output halftone pictures good enough for many desktop publishing projects on standard laser printers. Gray-scale editing programs are more powerful than ever, and leading the pack is *Gray F/X* from Xerox Imaging Systems.

If you use black-and-white photographs or other images with shades of gray in documents on a regular basis, this \$495 program is an essential tool. *Gray F/X* gives you the power to manipulate images in much the same way as when making a



photographic print in a darkroom, but without the messy chemicals and lengthy procedures. Want to change the contrast of the image? Need to burn in some details, or mask others? No problem.

The program does not stop there. You can "clone" elements of the picture—if you want to show San Francisco with an extra Golden Gate Bridge, go ahead. Other unusual special effects can make your image look like embossed paper or a shiny metallic sculpture.

You perform all this magic on a screen that displays true shades of gray on a VGA-equipped system, and you can see the effects of your changes as you make them. On the output side, you can print the images on a laser printer using various options that simulate line halftone and dot screens, or random patterns that look like a true photographic print. You can also save formatted images as disk files to be "dropped" directly into desktop publishing documents.

There are other programs with similar capabilities, but *Gray F/X* has an advantage in ease of use and the number of images you can work with at one time. The program can run in 640K, but Xerox recommends that you use at least 2MB of either extended or expanded memory. Without the extra RAM, the program relies on your hard disk for work space and spends a lot of time swapping portions of your image between memory and disk.

Throw away your triangles and blue pencils, and forget about stripping halftones into your final copy. Thanks to *Gray F/X*, you can retouch and enhance scanned gray-scale images and include them in your documents without ever leaving your mouse and keyboard.

FACT FILE

Gray F/X, Version 1.1; Xerox Imaging Systems Inc., 535 Oakmead Pkwy., Sunnyvale, CA 94086; (800) 248-6550, (408) 245-7900.

List Price: \$495. **Requires:** 640K RAM, hard disk, VGA display, DOS 3.0 or later. 2MB expanded or extended memory recommended; XT not recommended. **Reviewed:** October 16, 1990, page 240.

CIRCLE 427 ON READER SERVICE CARD



Gray F/X

OPERATING SYSTEMS 1990: Which Way Will We Go?

*Only a short time ago, the future seemed fairly clear:**OS/2 2.0 would appear and triumph**by virtue of its superior power and functionality.**How things have changed!***by Charles Petzold**

Standards in operating systems are as fundamental as railroad gauges and just as difficult to change. An operating system provides a platform for applications in the form of an application program interface (API). The API is the language through which applications communicate with the user, the file system, and the system's memory.

Applications are so tightly linked to the operating system API that a very successful operating system can actually be an impediment to industry progress. Operating systems survive much longer than their technical merit seemingly warrants. For example, what PC software besides DOS has been in continuous widespread use since 1981?

A new operating system requires a strong commitment from users and application developers. But users won't buy a new operating system unless applications are available for it, and developers won't write those applications without assurance of a market. A successful operating system, one that is technically excellent and earns good market share, is rare. In the world of operating systems, many are proposed; few are chosen.

HIGHLIGHTS AND DISAPPOINTMENTS

The operating system highlight of 1990 was the May introduction of *Microsoft*

Windows 3.0. Here Microsoft did almost everything right. *Windows* doesn't replace DOS but extends it into the realm of multitasking, windowing, and graphics. The new version of *Windows*



runs in protected mode and sports a spiffy colorful shell. Microsoft rolled out the product with an extravagant multicity celebration, and users and software developers alike responded enthusiastically. Nearly five years after its initial release in November 1985, *Windows* had finally arrived.

OS/2—which was developed jointly by IBM and Microsoft and once believed to be the heir to DOS—continued to stagnate. The IBM version of OS/2 1.2 was released in late 1989, but Microsoft's version for non-IBM hardware (eventually dubbed OS/2 1.21) was delayed for over half a year. Most users of non-IBM hardware still ran OS/2 1.1. Meanwhile, IBM worked on

a low-memory version called OS/2 1.3. The once-promised year-end 1990 release of OS/2 2.0—the version with the 32-bit API—became wishful thinking, although Microsoft did manage to release two beta versions with its \$2,600 OS/2 2.0 Software Development Kit.

(Pop quiz: What is the most recent version of OS/2? Essay question: What are the implications of the fact that this question can't be answered decisively?)

OS/2 is the idiot savant of operating systems. Deep down, it's brilliant—powerful and versatile with an elegantly designed API that clearly ranks at the top of operating systems for desktop computers. Yet on the surface it's a mess. OS/2 is a disk hog, a memory hog, burdened with a user shell that doesn't come close to that of *Windows 3.0*—and the victim of major marketing blunders by IBM and Microsoft.

A TALE OF TWO APIs

In a perfect world, OS/2 and *Windows* would not be competitors. The graphical interface of OS/2 (called the Presentation Manager, or PM) would be a step upward from *Windows*, a straightforward extension of the *Windows* API. It would be easy to move a program from *Windows* to the OS/2 Presentation Manager, and, in the process, give it both more power and better performance.

But this is not a perfect world. OS/2 may represent cooperation between IBM and Microsoft, but it also represents compromise. In convincing IBM to make *Windows* part of the OS/2 environment, Microsoft had to yield to requested changes that eventually became so extensive that the *Windows* and PM APIs drifted from twins to siblings to distant cousins.

CONTINUES

OPERATING SYSTEMS

CONTINUED

In 1990, Microsoft's answer to this incompatibility problem was the Software Migration Kit (SMK), a translation layer between the *Windows* API and the Presentation Manager API. You write a *Windows* program, run it through the SMK, and out pops an OS/2 PM program. It's the perfect solution for people who don't mind kludges.

The technical superiority of OS/2 and Presentation Manager over DOS and *Windows 3.0* is almost universally unquestioned. But standards are not born of technical excellence. Rather, standards result from market trends and political power.

Here the market (both users and software developers) spoke clearly: *Windows*, yes. OS/2, no. The early activity among software developers in writing PM applications slacked off in 1990 as everyone focused on *Windows*.

SEX, LIES, AND POLITICS

The political part of the equation remains unclear at the time of this writing. The marriage of convenience between IBM and Microsoft has always been troubled.

Despite the reaffirmation of the IBM and Microsoft vows at Fall Comdex in November 1989, the two companies seemed to drift apart more than ever during 1990. IBM worked on OS/2 1.3 on its own; Microsoft seemed more interested in pushing *Windows 3.0*.

When rumors broke in early September that Microsoft was ready to abandon OS/2 in favor of *Windows*, IBM and Microsoft responded with a joint press release that seemed to some to solidify the relationship, yet to others indicated quite a different direction for the industry. OS/2 1.x and 2.0 development was shifted to IBM, except for a *Windows* compatibility layer and a version of

OS/2 that will be portable to other processors. The agreement also instituted extensive cross-licensing for both OS/2 and *Windows*.

But considering how often IBM and Microsoft have repositioned OS/2 and *Windows*, you have to question how much of what they say these days is true. One widespread speculation is that OS/2 will become mostly an IBM product and that Microsoft will extend *Windows* as much as needed to remain competitive with OS/2. Perhaps at some point OS/2 and *Windows* will converge into a single system, but that seems far off.

With *Windows 3.0*, Microsoft seems to be letting IBM know that the Presentation Manager API should have been an extension of the *Windows* API. Microsoft is also demonstrating that it knows how to market operating systems while IBM does not, and insinuating that it controls the future of PC operating system software.

WHAT'S COMING UP?

It seems clear that desktop computing must move from 16-bit architectures to 32-bit architectures during this decade. Yet which 32-bit operating system will become dominant remains more uncertain than ever.

The only viable immediate 32-bit solution for PC-compatibles is Unix. The alternative is OS/2 2.0, but nobody expects to see a retail version (at least one with a reasonably short bug list) until mid-1991. Whether OS/2 2.0 will be the version that finally attracts the masses or whether it will be a presence only in IBM shops remains unclear.

Microsoft is leaving open the possibility of developing a future 32-bit version of *Windows* that will compete with OS/2 2.0. Can you say "nineteen ninety-two"?

SIDESHOW SPECTACLES

In the Interesting-But-Does-It-Really-Matter Department, several companies released (or planned to release) other operating system products. Compared with the turmoil surrounding OS/2 and *Windows*, these products are merely sideshows.

Future DOS development lies with Microsoft, which readied DOS 5.0 for release. DOS 5.0 requires less memory than DOS 4.0 but includes a graphical shell and some new features for users, such as a full-screen editor. Digital Research—the company that could have been the Microsoft of the 1980s—released DR DOS 5.0, a DOS clone that also leaves more memory available for applications and includes a graphical shell.

Meanwhile, GeoWorks cooked up a new DOS-based graphical environment called *Geos*. It's written in assembly language, so it's small and fast. Almost everyone who sees it says, "This is what *Windows* should have been." But unless GeoWorks scores a major coup (such as licensing *Geos* to IBM for bundling with the PS/1 80286-based machine), *Geos* is probably destined to be a historical curiosity.

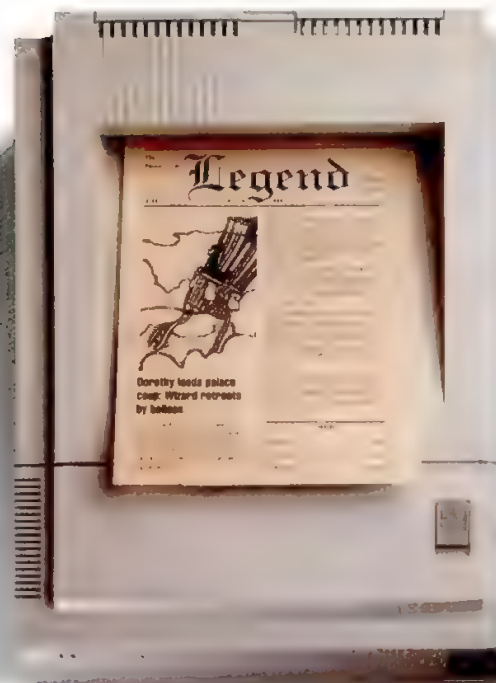
COMPLETELY CONFUSED

Unfortunately, a positive view of the future of PC operating systems is impossible at this time. As 1990 draws to a close, the key words in operating systems are confusion, uncertainty, anxiety, and doubt.

Unfortunately, the two guiding lights of this industry—IBM and Microsoft—are part of the problem rather than part of the solution. It's enough to make you want to buy a Macintosh.

Don't expect 1991 to be better. ■

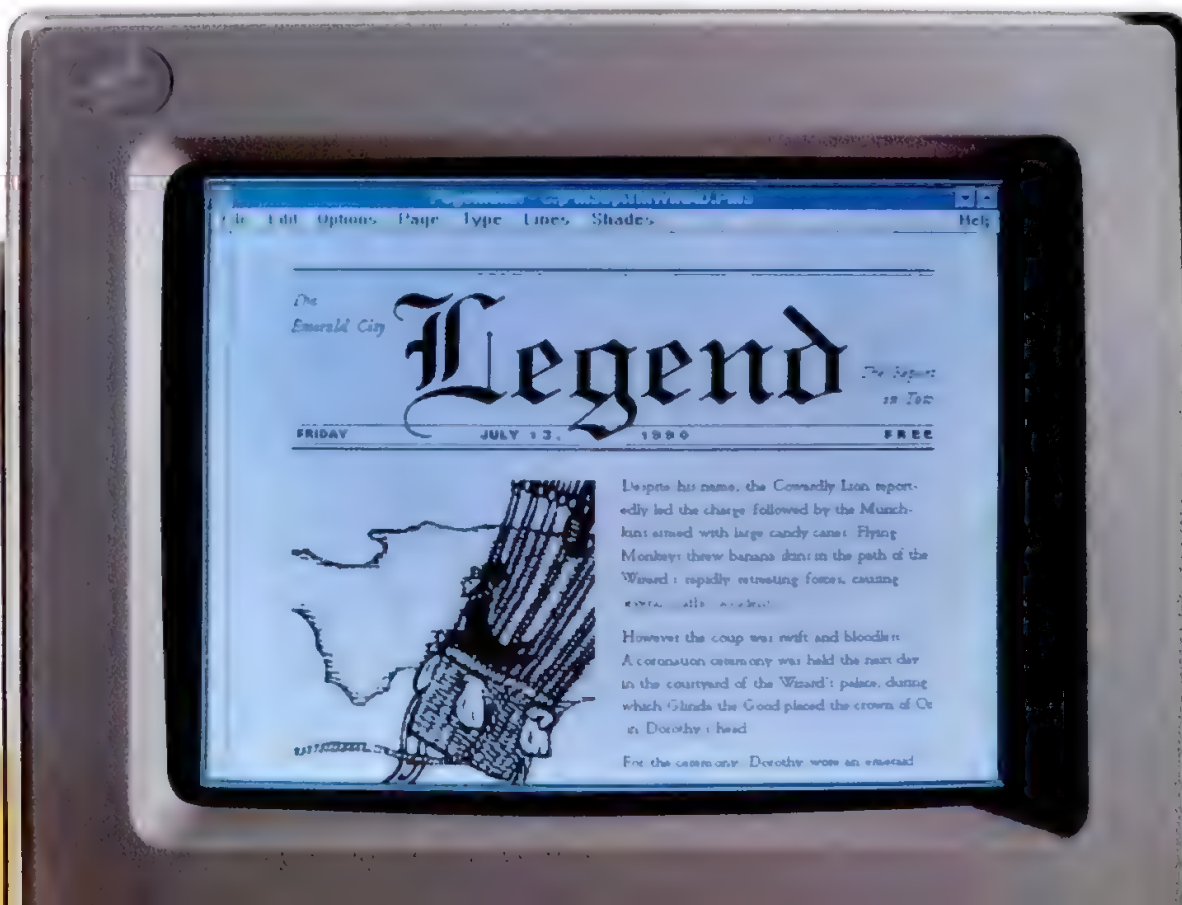
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These 13 popular fonts, which cost hundreds of dollars if purchased separately, are included with ATM software. To save even more, check out the Adobe® Plus Pack for \$198.* Along with ATM, it completes the full set of 35 fonts found in most PostScript printers. Or try Adobe Type Set® 1, 2 or 3—each with 7 to 11 fonts for just \$99-\$198.*

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Hercules Computer Technology Inc.

Hercules Graphics Station Card

by Tom Unger

Those who complain that graphics card functionality lags behind that of nearly every other PC component need complain no more. The Hercules Graphics Station Card combines an extraordinary set of features designed to handle your most . . . well . . . *Herculean* graphics tasks. A full-size ISA bus card, the Graphics Station can handle nearly all of your graphics display needs from regular VGA text and graphics processing to high-level image database and animation applications.

The Graphics Station Card combines three high-end formats: VGA, TIGA (using its on-board Texas Instruments 34010 Graphics Processor), and 16- as well as 24-bit high-definition color. It operates in interlaced or noninterlaced modes up to 1,024 by 768 pixels at 8 bits per pixel, includes 1MB VRAM, and allows for optional inclusion of up to 2MB DRAM to support program memory or display list processing in CADD packages. The Graphics Station card can operate with any analog monitor, and, according to a Hercules spokesperson, a TIGA driver that operates in full protected mode for *Microsoft Windows 3.0* should be available by the time you read this.

What is perhaps most extraordinary about this graphics card is its multifunctionality at a price of \$1,024. This means that you can find the Graphics Station Card at a street price of around \$750.

This card can save you money in other ways, too. For example, Hercules has worked with Time Arts of Santa Rosa, California, to port a version of TA's popular graphic arts program, *Lumena*, for use with the Graphics Station Card. If you wanted to use *Lumena* before this, you had to buy a TrueVision card at about three times the cost. Hercules bundles the Graphics Station Card and *Lumena* together and sells it for \$3,995 in a package called The Hercules Art Department, giving users a cost-effective way to achieve top-of-the-line graphics results from one card.

COVER STORY
BEST OF 1990

FACT FILE

Hercules Graphics Station Card; Hercules Computer Technology Inc., 921 Parker St., Berkeley, CA 94710; (415) 540-6000. **List Price:** \$1,024; with 2MB memory upgrade, \$1,495. **Requires:** VGA or analog multiscanning monitor, 80286 or better PC. **Reviewed:** August 1990, page 44.

CIRCLE 428 ON READER SERVICE CARD

Hewlett-Packard Co..

LANProbe Distributed Analysis System

by Frank J. Derfler, Jr.

A large segment of the population, particularly those of a technical persuasion, thinks cars need gauges, modems need lights, and network administrators need a real-time window into network activity. LANProbe is for those administrators, providing spectacular real-time views into the activities and halts of a network.

The LANProbe package consists of the LANProbe Segment Monitor and the NodeLocator (each installs at opposite ends of an Ethernet cable), and the *ProbeView* software, which runs on the network administrator's PC along with *Windows 286*. (The *ProbeView* console—an HP Vectra configured with *ProbeView*—costs \$12,750.) The system monitors, tests, and diagnoses activity on virtually every aspect of a network, displaying problems in cabling, communications software, traffic loads, equipment malfunctions, and even user errors. Designed for remote access, troubleshooters can view LAN activity from across the country as easily as they can see what's happening on their own desktop.

ProbeView's triggering and filtering options are essential tools in the all-important task of information management. They provide the administrator with the means of distinguishing the important from the inconsequential; the network manager simply chooses the important protocol and station combinations, and *ProbeView* captures only those packets.

In an impressive and practical display,



Hercules Graphics Station Card



LANProbe Distributed Analysis System

COVER STORY
BEST OF 1990

the software shows network performance using vertical bar charts. The charts depict packets per second, bytes per second, errors, collisions, and other information.

The LanProbe system automatically identifies all the active nodes and creates a map showing them in their actual sequence on the cable. The software lets you name nodes and supplies icons for servers and workstations. Each station icon includes information about the type of adapter installed, the location of the node along the cable, and other details.

LANProbe is a useful tool for any network manager. The quality and comprehensive design typical of Hewlett-Packard products shine through here.

FACT FILE

LANProbe Distributed Analysis System; Hewlett-Packard Co., 19310 Pruneridge Ave., Cupertino, CA 94304; (800) 752-0900.

List Price: HP 4993A ProbeView console plus ProbeView software, \$12,750; LANProbe segment monitor, \$4,470 to \$4,995; ProbeView software, \$5,000; NodeLocator, \$995. **Requires:** 2MB RAM, 40MB hard disk, Ethernet network, EGA or better display, Microsoft Windows 286, mouse. **Reviewed:** June 26, 1990, page 221.

CIRCLE 429 ON READER SERVICE CARD

IBM Corp.

IBM LaserPrinter E

by Tom Unger

IBM's 5-page-per-minute LaserPrinter E is one of the best in its class this year for some of the same reasons its 10-ppm sibling, the LaserPrinter, won our Technical Excellence Award last year: flexibility, upgradability, and superior engineering.

The \$1,495 LaserPrinter E is compact and quiet, has 512K RAM, and comes with four built-in emulations: IBM PPDS, IBM Graphics Language, Hewlett-Packard LaserJet Series II, and HPGL. A 1MB memory upgrade is available for \$499.

You can add one of two versions of the PostScript PDL: The \$499 Standard PostScript Option gives you true Adobe PostScript and 17 typefaces; for \$899, the Premium PostScript Option includes a font card with 22 more outline fonts, for a total of 39. The PostScript option ships on an easily installed daughterboard, and because this board is directly incorporated

into the main circuit board, you won't get the performance degradation found in cartridge solutions.

Other options make this the printer to beat when you are thinking not just of your current printing needs, but also about what you'll need tomorrow. IBM sells an optional and extremely reliable \$329 envelope feeder, a \$399 500-page-capacity paper drawer, and a printer-sharing option that allows serial access to the printer by up to six PCs. Should you feel the need for speed, you can upgrade to IBM's 10-ppm engine for \$1,099.

If you need an inexpensive laser printer today with an upgrade path that's the envy of the industry, this one's got it all.

FACT FILE

IBM LaserPrinter E; IBM Corp. (contact your local authorized IBM dealer); (800) 426-2468 (dealer information).

List Price: \$1,495; second paper drawer, \$399; envelope feeder, \$329. **Reviewed:** November 13, 1990, page 190.

CIRCLE 542 ON READER SERVICE CARD

Intel Personal Computer

Enhancement Operation

NetPort Print Server

Microtest Inc.

LANPort

by Frank J. Derfler, Jr.

Modern network managers often face drafting platoons of PCs into service as communications servers and print servers. Microtest and Intel now provide an alternative for network administrators thinking about recruiting yet another PC to act as a print server.

Microtest developed the LANPort; Intel licenses the technology, uses a modified design (incorporating the ability to quickly update the software in Intel's special Flash EPROM), and provides strong marketing support for what it calls the NetPort. Intel sells the system for \$695, while Microtest's prices vary from \$495 to \$695, depending on the type of printer connections you need. Microtest offers dual parallel and serial connec-



IBM LaserPrinter E



NetPort Print Server



LANPort

The Next Executive Best Seller.



A great executive best seller helps you succeed. And that's exactly the idea behind AST's new, 6.5 lb. Premium Exec notebook computers. Only 11.4" x 9" x 2.25", they're going to be the new source "book" for executives all over.

Premium Exec 386SX/20, starting at \$2995. What makes one brand of notebook computers a best seller, while others gather dust on the shelves? In the case of Premium Exec notebooks from AST, it's style, power, upgradeability, a wealth of standard features and an extremely attractive price.

Start with the keyboard. Does it remind you of the one on your desktop computer? It should. Our keyboard has 82 keys, including function keys and dedicated word processing keys. Also, an inverted "T" cursor pad and standard key spacing mean you don't have to figure out a whole new way of typing. It'll keep your fingers happy through the most frustrating of spreadsheets.

Now turn on the power. You'll be greeted by a real-life VGA screen with 32 shades of gray. Its "paper white" display provides a bright clear image, designed to reduce eye strain. This new CCFT film supertwist display is the

latest notebook display technology. It's brighter, offers higher contrast, uses less power and offers more reliability (up to three times longer than older EL technology) than ever before.

We offer you two choices of power, and upgradeability. With AST, you have the power of choice. That's why we offer either a 12 MHz, 80286, that can be upgraded to a 386SX/20 when you need it. (Remember, AST is the upgradeability company.) Or, you can go straight to the top and get an 80386SX running all the way up at 20 MHz. Zoom.

We didn't compromise on memory or storage either. Premium Exec notebooks come standard with 1 or 2 MB of high-performance, interleaved, page-mode memory, which you can expand all the way to 8 MB.

And both Premium Execs sport either a 20 or 40 MB lightweight, fast access hard drive. These

2.5" drives are also the latest in notebook technology.

Most computer companies would stop right there. But a best seller always offers more. Like our rechargeable NiCad battery, which provides more than

three hours of continuous operation. Or, our power conservation features, including a special "sleep" mode and power management BIOS. And, of course, we've provided all the right connections—to printers, external monitors, keyboards, modems, etc. So many, in fact, you'll be tempted to use your Premium Exec as your primary office computer.

To top everything off, we now offer a new service program option providing you with either expedited replacement or repair of your notebook computer.

Every successful executive needs an edge. Make the Premium Exec yours. Check one out for yourself. Or, give us a call, toll-free, at 1-800-876-4AST. We also have an On-line technical information network you can access with your modem—(714) 727-4723.

AST markets products worldwide: Corporate Headquarters, 36215 Alton Parkway, Irvine, CA 92718; United Kingdom and the Middle East, call 04 40 740 4 190; In Japan, call 03 3643 0700; in the Far East, call our Hong Kong office at 053 5 1004 4333; in Canada, call 416 824 7714; in Australia, call 01 2 974 2201. AST is a supplier to U.S. government agencies. General Service Company, 12001 S.W. 11th Avenue, Miami, FL 33157. AST, AST logo and Premium are registered and AST, trademark AST Business, Inc. All other product or brand names are trademarks or registered trademarks of their respective companies. Copyright 1990 AST Research, Inc. All rights reserved.



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COMPUTERS

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To Go

CIRCLE 166 ON READER SERVICE CARD

tions, while Intel provides only one serial and one parallel connection.

The LANPort and NetPort, each the size of a VCR tape at 4 by 7.5 by 1 inches, snuggle next to a printer and give it a direct connection onto a *NetWare* Ethernet LAN. The units draw print jobs from the queues on the file servers and print them out on their attached printers for the network users.

Here's how it all works. Normally, your networked PC's parallel and serial ports are assigned to specific print queues when you log onto a server. A printer attached to the LANPort or NetPort can be LPT1, while a printer elsewhere on the network can be LPT2. You simply tell your application program which port to use, and then tell it to print. The *NetWare* shell routes the print job to the proper print queue; if that queue is assigned to the LANPort, the job shows up on its attached printer. If you want to change queues or print without an application program, you can use PCONSOLE to create and control print jobs.

Customized software lets you install the units in just a few minutes. The programs keep the look and feel of *NetWare*, and the units show up on Novell's printer utilities just as a remote print server should.

The Intel NetPort and Microtest LANPort are innovative solutions to a problem of growing importance.

FACT FILE

NetPort Print Server; Intel Personal Computer Enhancement Operation, Mail Stop CO3-7, 5200 N.E. Elam Young Pkwy., Hillsboro OR 97124-6497; (503) 629-7000; tech support, (800) 538-3373.

List Price: \$695. **Requires:** Ethernet Thin Wire (10Base2, BNC Connector), *Novell NetWare* 2.1 and later or *Novell NetWare* 386. **Reviewed:** Not previously reviewed in *PC Magazine*.

CIRCLE 543 ON READER SERVICE CARD

FACT FILE

LANPort; Microtest Inc., 3519 East Shea Blvd., #134, Phoenix, AZ 85028; (800) 526-9675.

List Price: AUI to LPT1, AUI to COM1, \$495; AUI to COM1/COM2, BNC to LPT1, BNC to COM1, \$595; BNC to COM1/COM2, \$695.

Requires: Ethernet Thin Wire (10Base2, BNC Connector), *Novell NetWare* 2.1 or later or *Novell NetWare* 386. **Reviewed:** Not previously reviewed in *PC Magazine*.

CIRCLE 544 ON READER SERVICE CARD

COVER STORY BEST OF 1990

Accolade

Jack Nicklaus' Unlimited Golf & Course Design, Version 1.1

by Jonathan Matzkin

Jack Nicklaus' Unlimited Golf & Course Design is quite simply the best, most realistic golf simulation on the market for IBM PCs and compatibles. One of the first golf programs to take advantage of the VGA's 256-color 320-by-200 graphics mode, Accolade's \$59.95 software offers breathtaking scenery from tee to green. While a VGA adapter is essential for getting the most out of this stunning software, it is compatible with older graphics standards.

It's tempting to dwell on how great it all looks. But that would be a mistake because, above all, this is a great golf simulation. If your timing and swing are perfect, you can get an authentic rush of satisfaction from crunching a three-wood 240 yards or dropping a perfect putt into the cup on a fiendishly difficult green. But duffers beware; you can also hook or slice the ball into the woods if your timing is off. Sand, wind, water, bushes, and other obstacles are also well represented in this game.

Easily the best feature of *Unlimited Golf & Course Design* is the course editor, which lets you indulge your urge to design the golf course of your wildest fantasies. You can either start from scratch, with an undeveloped plot of land, or edit one of the two courses supplied with the simulation. Courses designed for *Jack Nicklaus' Greatest 18 Holes of Championship Golf* can be played in the new package, but they cannot be edited. The course editor comes as close to real course design as current PC technology allows, and the software manual provides a legitimate, if brief, introduction to course design.

Unlimited Golf & Course Design attracts both serious golfers and casual PC gamers. Even people who have never swung a club can find themselves hooked



Jack Nicklaus' Unlimited Golf & Course Design

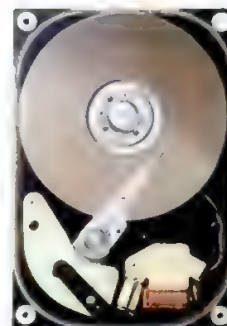
IT HAS BEEN
BROUGHT TO
OUR ATTENTION
THAT NOT EVERYONE
BELIEVES
PORTABLE PCs
CAN BE AS
FUNCTIONAL AS
DESKTOP PCs.



THIS SHOULD



This may be hard to believe, but there really is such a thing as a portable PC that can do everything a conventional desktop can.



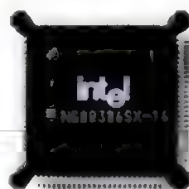
Some people can't imagine squeezing a 40, 100 or even a 200MB hard disk into a portable PC. But when they take advantage of all that storage capacity, they find it hard to imagine life without it.

In fact, there's not just one, but an entire line of them. They're called Toshiba Portable Desktops™, and they'll forever change the way your company looks at power and productivity.

To get more information or a free Portable Desktop productivity survey, call 1-800-477-1616.

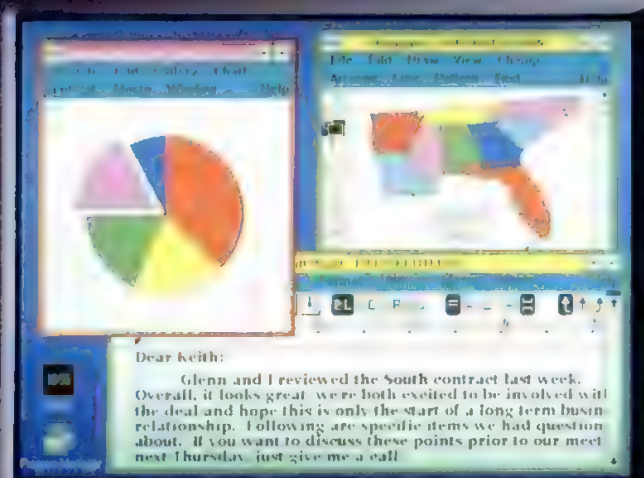
True, some business people may have trouble grasping the notion of desktop power in a portable, but when you give it some thought, it's the next logical step in computers.

There once was a day when microprocessors this powerful were unheard of in a portable. Luckily for people who crave raw power and computing speed, that day is over.

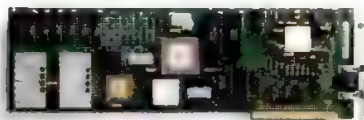


With 386™ and 386™SX microprocessors, our Portable Desk-

For those who think a PC just isn't fully functional without a color display, we developed our second-generation LCD color screen. For those who think basic is better, our VGA gas plasma systems have the perfect displays.



REMOVE ALL DOUBT.



To anybody who doesn't expect a portable PC to have IBM-compatible expansion slots, we have just one thing to say. Raise your expectations.



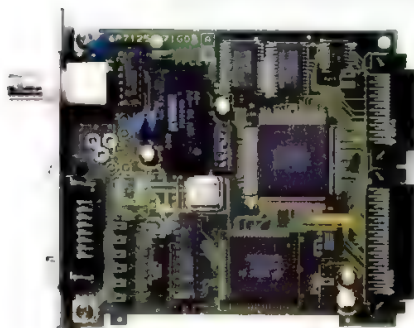
tops run all of the same applications as your company's conventional PCs.

With hard disk

drives from 40 to 200MB, you have all the flexibility to configure a system the way you want it.

With the connectivity of our multiple expansion slots and ports, our Portable Desktops fit right in with your existing system and grow as your company grows.

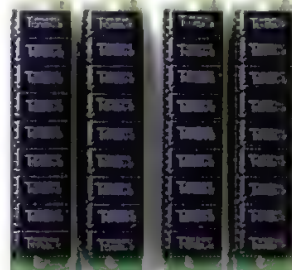
And to remove the last possible barrier between your needs and our portables, we've even designed one with a high-resolution VGA color screen.



With an expansion slot for a LAN card, you get complete networking freedom without giving up all your other expansion slots.



Anyone who insists portable PC users are doomed to cramped, undersized keyboards hasn't gotten their hands on a Toshiba. We use standard-size keys and standardized key spacing so your hands will feel right at home.



They say you can't squeeze much memory into a portable PC. But considering that our dedicated memory expansion slots let you add up to 12MB of RAM as your need for power grows, it looks like "they" were wrong again.

In other words, it really is possible to have all the capabilities of a conventional desktop in a portable.

All you have to do is try one. And believe.



T5200. 386 microprocessor, 40, 100 or 200MB HDD, 2 to 14MB RAM, 2 IBM-compatible expansion slots (in addition to dedicated memory slots), VGA plasma display.



T5200C. 386 microprocessor, 200MB HDD, 2 to 14MB RAM, 2 IBM-compatible expansion slots (in addition to dedicated memory slots), VGA passive matrix color LCD display.



T3200SX. 386SX microprocessor, 40 or 120MB HDD, 1 to 13MB RAM, 2 IBM-compatible expansion slots (in addition to dedicated modem and memory slots), VGA plasma display.

NOW THAT YOU'RE CONVINCED,



Okay, let's suppose you suddenly discover your company filled with powerful Toshiba Portable Desktops.

Now what?

First of all, your people can do everything around the office they've been doing with their desktop computers.

Then your key employees can turn after-hours time into productive time, since their dining room tables and breakfast nooks can serve as off-site workstations.

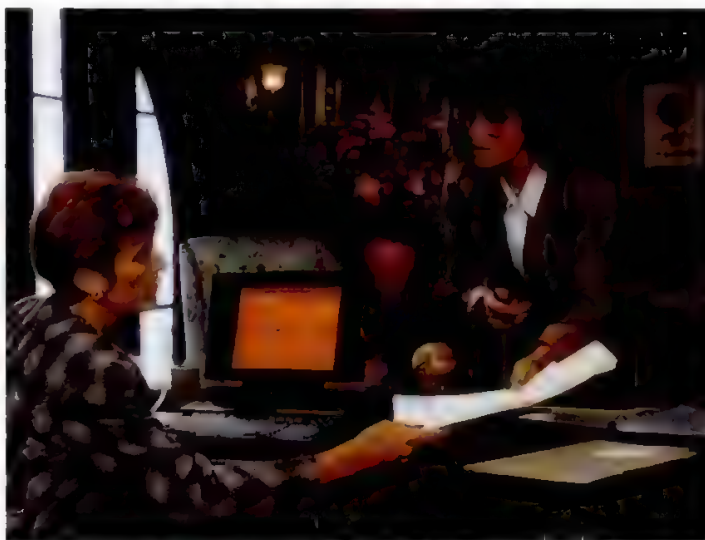
Your top people can add impact to their presentations with a

wealth of information and computing power at their fingertips. And the story can repeat itself—with

equally impressive results—everywhere from an office 3,000 miles away to a conference room that's a mere 30 feet down the hall.



Giving your people instant access to vital information can keep them doing what they do best. Working smart.



Employees can even improve their productivity in the familiar surroundings of their own office. Only now they'll have more desk space to work with.

To get more information or a free Portable Desktop productivity survey, call 1-800-477-1616.

WHERE DO YOU GO FROM HERE?



Giving your key employees a Portable Desktop means they'll have the flexibility to work when they need to, where they want to.



And yes, all that productivity can even take place within the confines of your own office desk (while using up considerably less of your desk space, we might add).

All of which leads us to one very powerful observation.



When people have access to computing power outside their office, presentations are more powerful and groups are more productive.

your best people can be doing a better job than they ever could when they were chained to conventional desktop PCs.

Better yet, they can do it without sacrificing power, functionality or expandability. Or anything else, for that matter.

Now all of



THREE POWERFUL ARGUMENTS WHY YOUR NEXT



People said it was just a matter of time before someone built a line of portable PCs this powerful. They just didn't know it would happen so soon.

With our Portable Desktops, we've successfully combined the power and functionality of desktop PCs into slim, portable packages that give you everything you need to get ahead in business.

T5200

18.7 pounds, 20MHz 80386 with 80387-20 coprocessor socket, 2 internal IBM-compatible expansion slots, 40MB hard disk with 25msec access or 100MB hard disk with 25msec access or 200MB hard disk with 16msec access, 2MB RAM expandable to 14MB, gas plasma VGA display with 16 gray scales, 1.44MB 3½" diskette drive.

T5200C

18.9 pounds, 20MHz, 80386 with 80387-20 coprocessor socket, 2 internal IBM-compatible expansion slots, 200MB hard disk with 16msec access, 2MB RAM expandable to 14MB, passive matrix VGA full-color screen, 1.44MB 3½" diskette drive



DESKTOP PC SHOULDN'T BE A DESKTOP PC.

So you get the same power. The same functionality. And the same expandability it takes to keep pace with your company's needs. The big difference is that with a Toshiba Portable Desktop, you can easily

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turn all that power into increased productivity.

All thanks to something no desktop PC could ever hope to offer.

The freedom to take it with you.

T3200SX

17.0 pounds, 16MHz 80386SX with 80387SX-16 coprocessor socket, 2 internal IBM-compatible expansion slots, 1 dedicated modem slot, 5 built-in ports, 40MB hard disk with 25msec access or 120MB hard disk with 19msec access, 1MB RAM expandable to 13MB, gas plasma VGA display with 16 gray scales, 1.44MB 3 1/2" diskette drive



DON'T TAKE OUR WORD FOR IT. GET A SECOND OPINION.



What do other companies know about our Portable Desktop PCs that you don't? If you had a copy of our free productivity survey, you'd know. For example, you'd know that 93 percent of portable users said that they'd never go back to using a conventional desktop. You'd know they've reported substantial increases in productivity.

And you'd know why they place so much value on the flexibility and freedom their portables have to offer. Toshiba Portable Desktops. They're no longer a matter of convenience, they're a matter of survival.

To get more information or a free Portable Desktop productivity survey, call 1-800-477-1616.



In Touch with Tomorrow
TOSHIBA

Toshiba America Information Systems Inc., Computer Systems Division.

CIRCLE 379 ON READER SERVICE CARD

on the beautiful graphics and superb overall playability of this brilliantly realized example of what a PC game can be.

FACT FILE

Jack Nicklaus' Unlimited Golf & Course Design, Version 1.1; Accolade, 550 South Winchester Blvd., #200, San Jose, CA 95128-2545; (408) 985-1700.

List Price: \$59.95. **Requires:** 512K RAM, DOS 2.1 or later, CGA or above graphics adapter; mouse optional. **Reviewed:** December 11, 1990, page 605.

CIRCLE 545 ON READER SERVICE CARD

Knowledge Garden Inc.

KnowledgePro Windows

by Richard Hale Shaw

By all accounts, 1990 seems to have at last been the year of *Windows*. In the forefront of the movement were the new application development tools for the Microsoft environment; of these, *KnowledgePro Windows* from Knowledge Garden stands out among the rest.

Designed to appeal to power users as well as to *Windows* developers, the \$695 *KnowledgePro* offers a robust development language and full support for native *Windows* objects. You can open multiple windows or dialogs in your application and customize their menus, control a window's border style, determine whether it's minimized or maximized, and set its title bar and icons. Creating and manipulating push buttons; radio buttons; check, list, and edit boxes; and hypertext regions is easy.

The *KnowledgePro* language is event-driven and message-based (like *Windows* itself), with the object-oriented facilities of multiple inheritance. This means that you can create classes of objects as well as a hierarchy of highly useable, easily modified source code.

KnowledgePro objects are built by creating "topics" that prescribe the behavior of an application and contain commands and functions. By linking a topic to a screen object (even to custom bitmaps), you can control whether the object reacts to a mouse click or the keyboard or both. You can also control what happens when the object responds—that is, whether it will send a message, display

hypertext, or open a new window.

With a rich function set and support for *Windows* Dynamic Data Exchange (DDE), *KnowledgePro* also has the ability to call and use any *Windows* Dynamic Link Library (DLL). That means you can create your own extensions (via DLLs written in C) or use any DLL provided by third-party vendors. In addition, *KnowledgePro* is a full-featured expert system development tool, with an inference engine and backward and forward chaining.

With runtime included royalty-free, it won't be surprising if *KnowledgePro Windows* is a smash with *Windows* developers of all types. By putting the power of *Windows* development in the hands of nonprogrammers, we may look back on the arrival of *KnowledgePro Windows* as the beginning of the *real Windows* revolution.

FACT FILE

KnowledgePro Windows; Knowledge Garden Inc., 473A Malden Bridge Rd., Nassau, NY 12123; (518) 766-3000.

List Price: \$695. **Requires:** 1MB RAM, *Windows* 3.0. Mouse recommended. **Reviewed:** Not previously reviewed in *PC Magazine*.

CIRCLE 546 ON READER SERVICE CARD

Lotus Development Corp.

Lotus 1-2-3/G Solver Module

by Craig Stinson

Most recent advances in spreadsheet technology have come in worksheet linking, charting, and formatting. While these have all added versatility and convenience to the genre, they haven't provided any new analytic capability.

One important exception in 1990 was the Solver module of *Lotus 1-2-3/G*, which performs linear and nonlinear constrained optimization tasks and produces bountiful and beautiful reports of its findings. Moreover, since *1-2-3/G* runs in OS/2, the Solver is able to do its work as an unobtrusive background task.

The Solver does more than report optimal solutions to a problem (the most



KnowledgePro Windows



Lotus 1-2-3/G

PCs 1990: The Year in Review

Workgroup computing, miniaturized components, the decline of the 20-MHz DX chip, and challenges to Intel marked the personal computer industry in 1990.

by Jennifer Zaino

The personal computer industry in 1990 was marked by extremes, with the behemoth Compaq Systempro representing one end of the spectrum and the tiny TI Travelmate 2000 and Sharp PC-6220 the other. But these machines are more than the sum of their parts: They represent the increasing LANization of personal computing on the one hand and the miniaturization of components on the other.

The evolution of personal computing into workgroup computing got a boost from the introduction of the Systempro. While not the only PC-based system to use multiple processors (which allow more users to be served simultaneously with minimal performance degradation), the Compaq Systempro has the added benefit of linking its eight drives through its Intelligent Drive Array controller. The Intelligent Drive Array controller processes multiple user read and write requests simultaneously, thereby hastening data read and write times under a network load. The Systempro makes a fine server for your Unix, Novell, or LAN Manager local area network now and will be an even better choice when system software that is capable of splitting the load among its processors is available.

Even the design of some systems makes you wonder about the ever-closing gap between personal and network computing. Particularly in the 386SX arena, some machines slimmed down to the point where you *almost* couldn't tell them from diskless workstations. These

slimline cases, typified by the Northgate 386/SX20, made their first appearance in the SX marketplace in 1990 with good reason: Though they may be used as workstations and entry-level machines, few 386SXs are going to be used as file servers (however IBM may plead the contrary). That means they don't need to pack oodles of room for storage devices and add-in boards; you'll typically get room for only three drives and four add-in boards.

The secret to many of these systems is integrating as many components onto the motherboard as possible, a phenomenon we first saw in 1989. In 1990, in addition to placing serial, parallel, mouse, and game ports on the system board, SX vendors began integrating the drive controllers into the system board (something that is also becoming popular in higher-end machines). Plain-vanilla VGA wasn't built into the motherboard as often as it used to be, since even many of the 386SX manufacturers opted to equip their machines with Super VGA adapter boards. Twinhead's Superset 590 machine is one exception to that, building in a video controller that supports TTL and analog monitors from MDA to VGA and will also support Super VGA modes if you fill the additional eight motherboard DIP sockets for a total of 512K video RAM.

GOING DOWN, DOWN

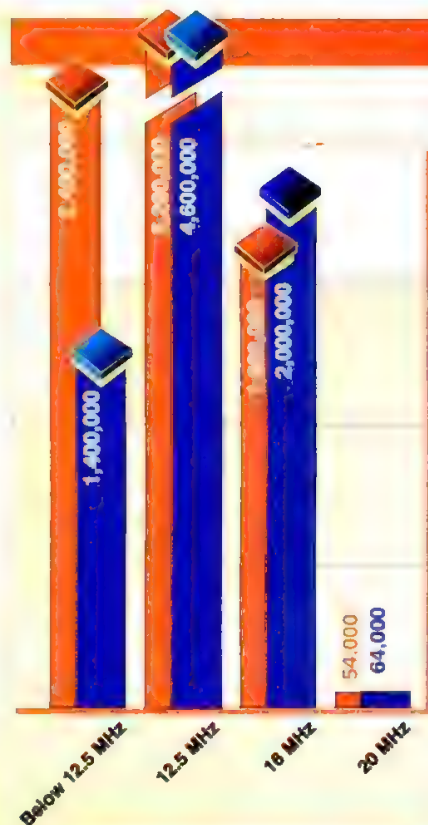
Desktop machines aren't the only systems getting smaller. Downsized components made the 1.5- by 11- by 8.5-inch (HWD), 4.5-pound Sharp and TI

machines possible. For instance, both systems use PrairieTek's 2.5-inch, 20MB hard disk. Other notebooks, like Toshiba's T1200XE, use Conner Peripherals' 20MB 2.5-inch hard disk. Both disks require a single 5-volt power supply to operate, which means that smaller power supplies and fewer bat-

CONTINUES



THE FUTURE OF PROCESSOR CLASSES



286

Source: In-Stat Inc., Scottsdale, Arizona

PCs 1990

CONTINUED

teries can be used. And that means overall system weight and cost are reduced. Also getting in on the 2.5-inch hard disk game are Toshiba, with its 40MB Mercury 40, and IBM, which demonstrated a 60MB drive early in the fall.

Display technology has taken a giant leap downward, too, with Reflection Technology's Private Eye display that produces a 12-inch 720- by 280-pixel

screen image in a device measuring 1.2 by 1.3 by 3.5 inches (HWD). The product is being sold as an add-on with an interface that plugs into laptops and desktops, but Cyberspace Corp. has announced a laptop measuring 5.5 by 11 by 1.88 inches (HWD) that will incorporate the technology.

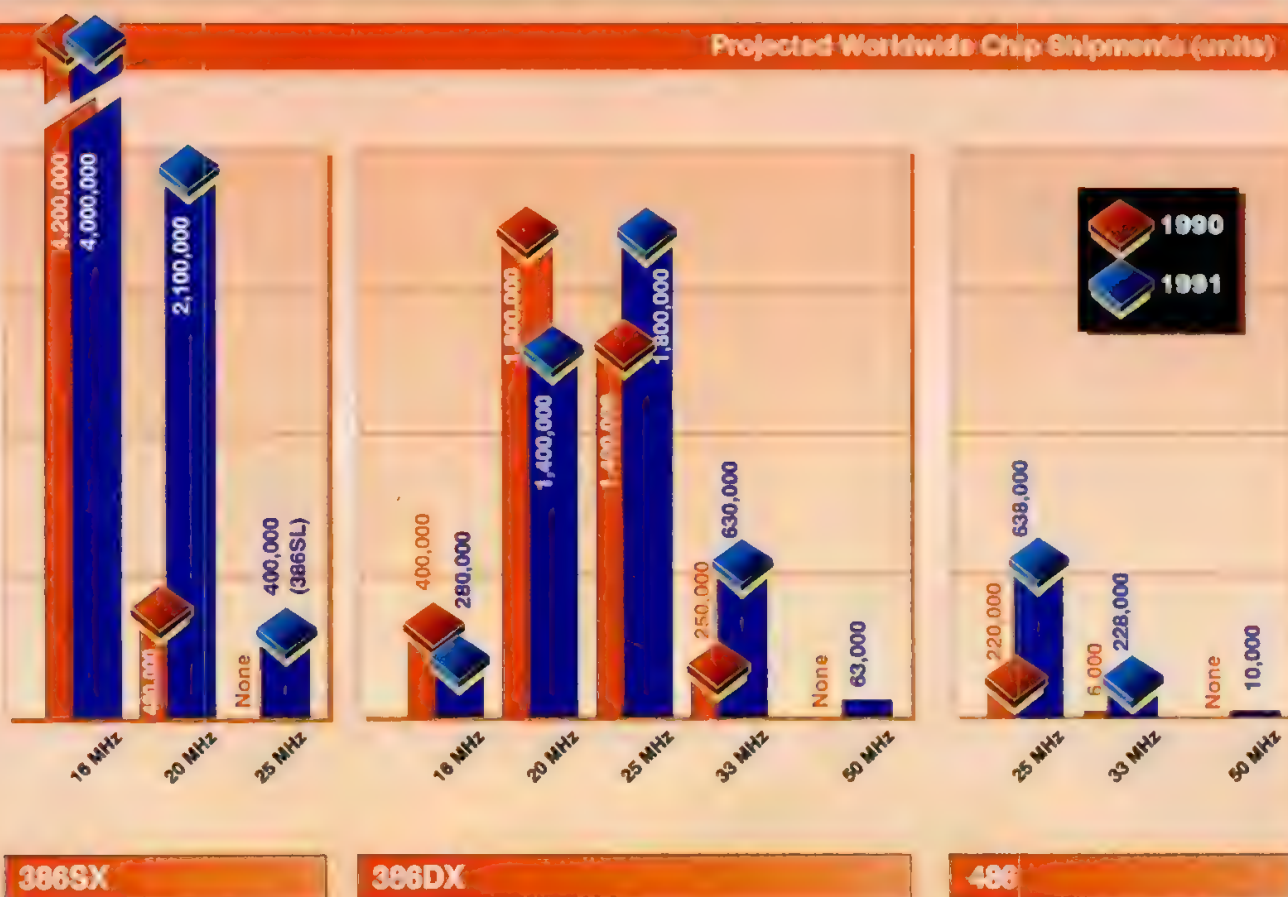
A smaller component count always means greater reliability, and that's rea-

son enough to celebrate AMD's announced AT-on-a-chip, which includes just about everything but ROM and a 287. In line with that, Intel is planning to go into volume production of its recently announced 386SL microprocessor chip in the first quarter of 1991.

The 20-MHz SL chip, which has the core microprocessor functions of the

CONTINUES

Projected Worldwide Chip Shipments (units)



PCs 1990

CONTINUED

SX, integrates a cache controller, main memory controller, a 387SX coprocessor interface, LIM EMS 4.0 mapping logic, and power conservation logic; the 82360SL I/O subsystem chip provides all the serial, parallel, DMA control, memory refresh, interrupt control, and hard disk interface functions.

The Intel microprocessor and subsystem chip are designed to enhance notebook functionality (think how they might affect the desktop market, too!), potentially providing the double benefit of reducing the size of portable PCs while increasing battery life. While users could see laptops based on this chip in the near future, slimmer high-capacity hard drives and displays that use less power and yet accommodate higher resolutions are needed in order to really bring the power of your primary machine down to notebook size.

THE CHIPS ARE DOWN . . . AND UP

1990 was the year in which we actually got to see MCA machines from companies other than IBM and Tandy; EISA also seemed poised for the long haul. Taking into consideration all manufacturer-designated model variations, we last counted 81 MCA machines and 57 EISA systems on the market with 386SX or better processors.

In "The Bus Wars" (*PC Magazine*, June 26, 1990), we declared the ISA bus to be the winner for real-world value in single-user DOS computing applications, although it ties with the EISA and MCA buses in terms of speed. In the chip wars, the situation is equally clear-cut . . . and equally blurry.

For one thing, International Data

Corp. (IDC) in Framingham, Massachusetts, projects the number of shipped 286 systems in the U.S. will decrease dramatically, from 3.6 million in 1990

the same price is awfully strong evidence that the company is trying to squash the slower processor. And besides, systems that are based on the

*While the 20-MHz DX chip may
meet its end, the 25-MHz 386 chip is
expected to continue as the basic
bread-and-butter workstation
processor through 1991.*

to 2.6 million in 1991. In contrast, its figures show the number of shipped 386SX machines in the U.S. increasing a little over 50 percent in 1991 (to 3.2 million), and the number of 386DX machines growing from 1.7 to 2.4 million over the same period.

That's cut and dried enough, but other things are changing more quickly. In 1989, the 20-MHz 386 was the mainstream machine of choice; by July of 1990, 25-MHz 386 systems had taken over the midrange of the 386 market. By the end of 1990, the 386/33 PC had also gone from being an expensive hotshot item to affordable workhorse system status.

From all accounts, the fate of the 20-MHz 386DX is as bleak as that of its nearly dead 16-MHz counterpart. In-Stat of Scottsdale, Arizona reports a projected drop from 1.8 million 20-MHz DX chips shipped worldwide in 1990 to 1.4 million in 1991. Though Intel may be denying it, the fact that it's selling 20- and 25-MHz 386DX chips at

20-MHz 386SX chip run almost as fast as 20-MHz DX systems in many real-world applications that aren't set up to take advantage of 32-bit data and address paths. The 20-MHz SX chip takes less than 10 percent longer than the 20-MHz DX processor chip on the 80386 Instruction Mix and Floating-Point calculation in PC Labs' benchmark tests.

While the 20-MHz DX chip may meet its end, the 25-MHz 386 chip is expected to continue as the basic bread-and-butter workstation processor on through 1991, with In-Stat projecting 400,000 more 25-MHz chips shipping worldwide this year than did in 1990. And while *PC Magazine* has reviewed more 33-MHz 386 machines in a single issue than we've ever done for any other product category, In-Stat is projecting a total of only 630,000 of those chips to ship worldwide in 1991, up from 250,000 in 1990.

CONTINUES

PCs 1990

CONTINUED

The 486/25 may be supplanted by the 486/33, but not anytime soon. With a projected worldwide chip shipment of 228,000 in 1991, production of the 33-MHz 486 chip will still lag behind the 25-MHz version, with projected shipments of 638,000 chips worldwide in 1991.

In 1991, we're likely to see a 50-MHz 486 and possibly a 386/50 (not to mention the rumors about a 25-MHz SL). It's not likely that these anticipated chips will disrupt things enough to knock any other processors out of the ring in the coming year, but a couple of upstart, would-be processor makers could have more-far-reaching implications for the marketplace.

WHAT'S IN STORE FOR INTEL?

While Intel has singlehandedly managed to hold the market by refusing to specifically license its 386 technology, word has it that AMD is close to introducing an 80386 processor and a 387 coprocessor. Compaq's hookup with NextGen for the purposes of cloning a 386 could prove an even greater threat to the Intel monopoly; it's also been reported that Chips and Technologies is working on its own 386 clone and 387 coprocessor. Add to this equation Integrated Information Technologies, which has announced plans for a 486-compatible chip.

While none of these projects are likely to affect the 1991 market greatly (and, in fact, none of these companies have any significant representation in the graph of worldwide chip shipments above), 1992 could be a very different story. One of the interesting stories to watch is whether the clone processor manufacturers will open up the floodgates that will unleash cheap 386 chips in all varieties—not to mention 486s—and send Intel scrambling. ■

COVER STORY BEST OF 1990

profitable allocation of resources, for example, given real-world limits on materials, personnel, time, and other factors). At your option, it also reports all feasible solutions—every solution that satisfies the stated constraints, whether or not it produces a theoretically optimal bottom line. With these results in view, a decision-maker can factor in issues that can't be precisely quantified.

Linear optimization (LP) programs have been available to spreadsheet users for some time. For example, General Optimization sells a fine 1-2-3 accessory called *What's Best*; Quattro Pro has a built-in LP module; and Frontline Systems offers a Release 2/Release 3 add-in called *What-If Analyst*. But these programs solve only linear problems and most require some degree of specialized training. The Solver handles many real-world problems not amenable to linear methods and makes its services available to anyone with reasonable spreadsheet competence.

The Solver is a welcome addition to the spreadsheet user's toolkit. It's a feature that's already drawn one add-in imitator (from Frontline), and is almost certain to be a component of future spreadsheet programs from Microsoft, Borland, and other competitors.

FACT FILE

Lotus 1-2-3/G Solver Module; Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.
List Price: \$695. **Requires:** 5MB RAM, OS/2 1.1 or later. An 80386 PC recommended.
Reviewed: August 1990, page 363.

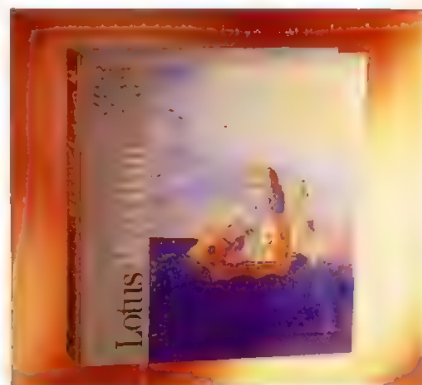
CIRCLE 547 ON READER SERVICE CARD

Lotus Development Corp.

Magellan, Version 2.0

by Matthew J. Ross

Version 2.0 of Lotus Development Corp.'s *Magellan* is everything a sequel should be. The ability to zip and unzip files, new file viewers, and an improved macro language make a great product even better.



Magellan

BEST OF 1990

Magellan 2.0 creates an index of the entire contents of your hard disk, which it then uses to rapidly locate desired files. Simply by typing the desired word or words, the \$139 program will quickly list all files that contain the matching string. Using the edit viewer, you can make quick changes to the file, and searches can be confined to certain files and subdirectories to speed the process.

The latest release increases the number of files you can view in their native format. The new *Magellan* includes viewers for *Lotus 1-2-3*, ASCII, as well as popular (and not so popular) word processor files, but to that it also adds viewers for *Microsoft Excel* and *Quattro Pro* spreadsheets, as well as *dBASE* and *Paradox* database files. Release 2.0 also has the capacity to display graphics files including .PCX, CompuServe .GIF, Lotus .PIC, and Lotus *Freelance Plus* .DRW formats. With more than 40 file viewers available, *Magellan* more than outpaces its competition.

What makes *Magellan* special is that after you've found the desired file, you can act on it. Version 2.0's hard disk management capabilities let you copy, move, delete, back up, or compress (using *PKZIP*) the file, as well as view previously zipped files. The program's features work on multiple marked files and subdirectories, too. Finally, its Undelete function returns a list of deleted files that can be recovered from your hard disk.

Magellan allows you to use your computer the way you run your life. Its customizable interface and macro facility permit you to remap the functions associated with the function and Ctrl or Alt key combinations and reduce the number of necessary keystrokes. *Magellan*'s word index adds only from 5 to 8 percent disk storage overhead, and this is quickly recoverable by zipping infrequently used files. Few packages better combine speed, flexibility, and ease of use.

FACT FILE

Magellan, Version 2.0; Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.

List Price: \$139. **Requires:** 512K RAM, hard disk, DOS 2.1 or later. **Reviewed:** May 29, 1990, page 43.

CIRCLE 540 ON READER SERVICE CARD

Microsoft Corp.

Microsoft BASIC Professional Development System, Version 7.1

by Ethan Winer

If there remains any doubt about BASIC's suitability as a serious programming language, one look at the \$495 *Microsoft BASIC Professional Development System (PDS)*, Version 7.1 will set the matter straight. This latest release is jam-packed with features that could easily make many C and Pascal users jealous.

For openers, Microsoft has enhanced its now famous editing environment to take advantage of expanded memory. Subprograms, functions, and numeric arrays are automatically swapped to EMS as the program runs, allowing a much greater capacity during the program development cycle. Indeed, applications comprising many megabytes of source code can now be developed entirely in memory. Add to that ISAM file handling, string data capacity of 192K, and arrays within TYPE structures, and we've still only begun to describe the wealth of features this latest version has to offer.

Several new BASIC statements have been added: REDIM PRESERVE lets you alter the size of an array, but without destroying its contents. DIR\$ and CURDIR\$ allow access to file and directory names, so there's no need to use assembly language. A new Currency data type is ideal for financial calculations, and the BYVAL directive can now be used when calling BASIC subprograms and functions. BYVAL is particularly powerful, because it halves the amount of code needed to access incoming parameters.

Equally important in this release is support for overlays. Long overdue for BASIC, this powerful feature greatly simplifies the development of large applications. Local error-handling has also been added, along with increased code optimizations. Finally, a series of BASIC toolbox libraries are included to provide code



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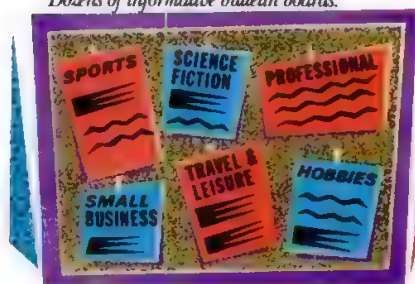


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COVER STORY
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examples for creating menus, dialog boxes, presentation graphics, and financial calculations.

BASIC PDS is a serious product intended for serious developers. Be prepared, however, to set aside between 3MB and 12MB of hard disk space to install the package, depending on which of the many options you plan to use. And while EMS memory is not an absolute requirement, it is strongly recommended to take advantage of the expanded program capacity.

This professional BASIC definitely lives up to its name.

FACT FILE

Microsoft BASIC Professional Development System, Version 7.1; Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; (206) 882-8080.

List Price: \$495. **Requires:** 640K RAM, hard disk, DOS 3.0 or OS/2 1.1 or later. **Reviewed:** Not previously reviewed in *PC Magazine*.

CIRCLE 549 ON READER SERVICE CARD

Microsoft Corp.

Microsoft PowerPoint for Windows

by Luisa Simone

Microsoft PowerPoint for Windows is a strong antidote for a disease that afflicts every PC graphics user: Mac envy. *PowerPoint* is the first PC-based presentation program to use powerful Mac-like conventions such as Master Slides, Slide Sorter overviews, object orientation, and a true WYSIWYG display.

Suddenly, the idea of filling out boring data sheets with cryptic formatting options is obsolete. With the \$495 *PowerPoint*, you can manipulate words and graphics directly. The WYSIWYG text and tab features are simple to learn and flexible to use. An extensive 400-image clip-art library and the ability to import all major raster and vector file types mean that even nonartists will be able to incorporate good-looking pictures into presentations.

PowerPoint takes full advantage of the *Windows* 3.0 environment via client windows and embedded DDE objects. As a result, double-clicking on an embedded *PowerPoint* graph will bring up the underlying spreadsheet in a separate win-

dow, so editing the numerical information is a snap.

Most importantly, *PowerPoint* provides tools to easily manage not only individual images, but entire presentations. Master slides contain the visual elements (like a company logo) that should repeat on each slide. The Slide Sorter view makes reordering your presentation as simple as dragging a thumbnail image to a new location. And the totally automatic Speaker Notes and Handouts are a presenter's dream come true.

Though many presentation programs scheduled to be shipping by the time you read this (notably *Aldus Persuasion*), and others that are soon to be released, promise these features and more (like built-in outlining capability), *PowerPoint's* flat learning curve will be hard to beat.

True WYSIWYG operation extends (finally!) to output on 35-mm. slides and overheads. Though you are limited to the Genigraphics film recorder driver, Genigraphics and Microsoft have worked out an almost foolproof color palette. If you have an extended VGA card, the color match between the screen and final film is nearly perfect.

PowerPoint is a presentation program that doesn't try to be all things to all people: Artists may find the graphics tools too primitive for serious use, and statisticians may thumb their noses at the anachronistic charting module that has basically been lifted from *Excel*. But business users who produce word charts and simple graphs will never even notice those deficiencies—they'll be much too busy producing high-quality presentations.

FACT FILE

Microsoft PowerPoint for Windows; Microsoft Corp., One Microsoft Way, Redmond, WA 98052; (800) 426-9400, (206) 882-8080.

List Price: \$495. **Requires:** 1MB RAM (2MB recommended), hard disk, *Microsoft Windows* 3.0. Extended VGA display with a 256-color *Windows* 3.0 driver, 80286 PC or better recommended. **Reviewed:** August 1990, page 43.

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CIRCLE 179 ON READER SERVICE CARD

Microsoft Corp.

Microsoft Project for Windows

by Don Willmott

If any one application is utterly transformed by a graphical interface, it's project management. Sure, over the years we've seen project management packages that have operated either under *Windows* or with a proprietary graphical interface, but the arrival of *Windows 3.0* last May and *Microsoft Project for Windows* soon after really showed us what project management can and should be.

This \$695 Editor's Choice invites new project management users to experiment with the concept in a friendly, up-front environment mercifully devoid of an unending series of intimidating task forms to fill out.

The package has a complete set of scheduling and tracking features, all of which are presented with excellent graphics in clear, functional data screens. Creating new views of a project is usually a matter of clicking on a couple of icons, and any two views can be displayed together so that you can, for example, combine a Gantt chart with a PERT chart or a histogram with a task form. You can also filter and customize these hybrid views and save them for later use.

Project for Windows gives you unprecedented control over the formats of both the on-screen displays and the printed reports, from font type and size to the colors and styles of task bars and connecting lines. If you don't have a very good plotter before you buy this package, you'll soon see why you need one.

The *Windows* interface endows *Project for Windows* with the tools to manipulate the task bars on the Gantt chart and the boxes on the PERT chart directly. Though hardcore project managers may complain that such features are pure flash and that no one really plans a project that way, direct manipulation is a great way to play "what-if" and to brainstorm in a group. Pop-up boxes on the Gantt chart present date information or task coordinates as you work with task bars and scroll through the project.

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Currently missing from *Project for Windows* are priorities for projects, cost diagrams, a time-scaled network diagram, and the ability to enter inflation costs. Microsoft had better keep on its toes because the arrival of some promising though as yet unreleased products may further shake up this market. We're happy to hand out these laurels, but don't rest on them too long, Microsoft.

FACT FILE

Microsoft Project for Windows; Microsoft Corp., One Microsoft Way, Redmond, WA 98052; (800) 426-9400, (206) 882-8080.

List Price: \$695. **Requires:** 1MB RAM, DOS 3.0 or later, *Windows 3.0*. Mouse recommended.

Reviewed: September 11, 1990, page 352.

CIRCLE 601 ON READER SERVICE CARD

Microsoft Corp.

Microsoft Word for Windows, Version 1.1

by Don Willmott

Word processors and graphical user interfaces: At first, the two seem mutually exclusive. Why do you need pictures, icons, and buttons when you're dealing with text? Don't you want *WordPerfect's* blank slate?

Maybe you do, but *Microsoft Word for Windows*, which was selected as an Editor's Choice, is one word processor that has the potential to make you consider switching packages, no matter how loyal you are to your trusty old character-based program. (Another *Windows*-based word processor that gets our best-of-the-year commendation and that also won Editor's Choice, Samna's *Ami Professional*, is distinguished from *Word for Windows* by being easier to use, though not nearly as deep in the programmable features that make *Word for Windows* such an interesting product.)

The \$495 *Word for Windows* has both an exceptionally strong set of traditional word processor features and an innovative set of macro and merge tools that provide automated control over data. The program makes possible documents that



Microsoft Project for Windows



Microsoft Word for Windows

request user input as soon as they are created and that summon information from other files and other applications. The magic behind all this are fields, prompts that can be programmed to ask users for information, run elaborate macros, pull in data from other applications, and preformat documents to an extent not seen before.

Word for Windows' use of the *Windows* interface isn't as smooth as it should be in some places, but it has more keyboard shortcuts and conveniences than any other GUI-based word processor on the market—and most character-based ones. You can open nine documents at once and you can edit two different parts of a document on the same screen at the same time.

Though PC Labs benchmark test results don't show it definitively, many *Word for Windows* users complain that the software is very slow to print. And if you run *Windows* on a machine that's underequipped in either horsepower or memory, you'll suffer. (We recommend a 20-MHz 386SX or 386 machine with 4MB RAM.) Microsoft is busily working on performance-improving enhancements, but that doesn't mean you should wait before taking a look at what it has to offer. The graphical future of computing is well worth exploring now, and *Word for Windows* is a fascinating glimpse ahead.

FACT FILE

Microsoft Word for Windows, Version 1.1; Microsoft Corp., One Microsoft Way, Redmond, WA 98052; (800) 426-9400, (206) 882-8080. **List Price:** \$495. **Requires:** 640K RAM, DOS 3.0 or later, *Windows* 2.11 or later. *Windows* 3.0 recommended. **Reviewed:** December 11, 1990, page 139.

CIRCLE 602 ON READER SERVICE CARD

NEC Technologies Inc.

NEC Intersect CDR-35 Portable CD-ROM Reader

by Douglas Boling

Who says portable computers can't be equipped with just about everything that their larger deskbound counterparts can accommodate? NEC Technologies' Intersect CDR-35 Portable CD-ROM drive provides laptop users with mega-storage

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capabilities at a cost of only \$599.

The CDR-35 squeezes a fully functional CD-ROM reader into a tiny 2.5- by 5.5- by 8.5-inch (HWD), 2.2-pound package. One of the first portable CD-ROM readers on the market, the CDR-35 reads both 5-inch and 3-inch CD-ROMs. When you're not running off AC current, the optional \$79 internal battery (0.7 pounds) powers the CDR-35 for 90 minutes of continuous use.

Hooked to a portable computer via a SCSI interface, a CD running in the CDR-35 provides the traveller with up to 540MB of data. With the growing volume of materials on CD-ROM (a company can store entire sales catalogs or repair manuals on CDs), the CDR-35 can become a mobile reference library, ready with an answer when you need it.

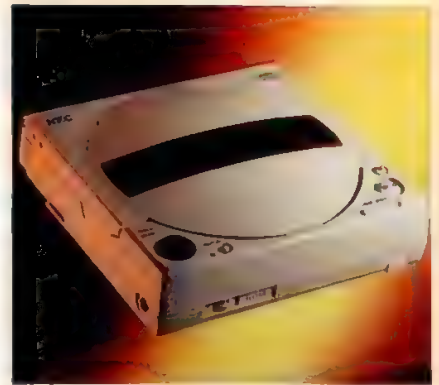
The CDR-35 is equally comfortable attached to your desktop machine. Its small size allows it to fit quite nicely on top of an external modem. While the 1,500-millisecond average access time is much slower than the 500-ms. access times averaged by most nonportable CD-ROM readers, the drop in speed is not noticeable in most situations.

Portable CD-ROM drives like the NEC could be the key to the sluggish CD-ROM industry. The ability to carry volumes of reference materials to remote locations is a true business need. And when you're done with work, you can not only play audio CDs on the CDR-35 but also get pause, repeat, and seek-to-track controls that most other CD-ROM players don't have. The volume control and earphone jack that come with the NEC are standard on most other CD-ROM readers, but a window displaying the track being played is a nice extra.

FACT FILE

NEC Intersect CDR-35 Portable CD-ROM Reader; NEC Technologies Inc., 1255 Michael Dr., Wood Dale, IL 60191; (708) 860-9500. **List Price:** \$599; optional battery, \$79. **Requires:** SCSI interface kit. **Reviewed:** Not previously reviewed in *PC Magazine*.

CIRCLE 603 ON READER SERVICE CARD



NEC Intersect CDR-35 Portable CD-ROM Reader

Symantec Corp.

The Norton Utilities, Version 5.0

by Lori Grunin

The Norton Utilities is one of those software packages that has saved almost everyone's computing life on at least one occasion. Whether the task was repairing a damaged file with the sector editor, unerasing a file you mistakenly deleted, or unformatting an accidentally blown-away hard disk, you're more than likely one of the growing number of panic-stricken users who, at some point, found yourself typing NU and murmuring a little prayer.

Version 5.0 of *The Norton Utilities* (now available for \$179 from Symantec) will be answering more prayers than ever before, thanks to new features like virus protection, a low-level hard disk formatter, temporary storage for previous generations of files, and a file-fixer for .WK1 and .DBF files.

And there's my favorite, most-used tool: the enhanced hex editor. Now it can display files as full-screen ASCII—not just as a strip down the right side of the display—broken up by sector, making it easier to spot which portions of your file have been trashed. The hex editor also highlights the chains that comprise a file within the FAT, allows you to split the screen into two windows, and cut and paste.

Added to that is a much-overhauled System Info, which spews forth more data about the state of your machine at any given moment than you ever thought you needed. Wrap it all up in a brand-new mouse-compatible interface that agglomerates all those small executable files that used to comprise the *Utilities*, and you've got a shiny new doctor's bag of tricks for your PC.

Of course, not everyone is thrilled by the new all-in-one interface; after all, loading an entire program is much slower and clunkier than typing FF FOOBAR.* at the DOS prompt. And the program still has quite a few—albeit nondestructive—bugs. But the new features alone could account for its best-of designation, prom-

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ising as they do to help even more desperate users emerge from the depths of hard-disk despair.

FACT FILE

The Norton Utilities, Version 5.0; Symantec Corp., 10201 Torre Ave., Cupertino CA 95014; (408) 253-9600.

List Price: \$179. **Requires:** 512K RAM, DOS 2.0 or later. Hard disk recommended. **Reviewed:** October 16, 1990, page 36.

CIRCLE 604 ON READER SERVICE CARD

Polaris Software

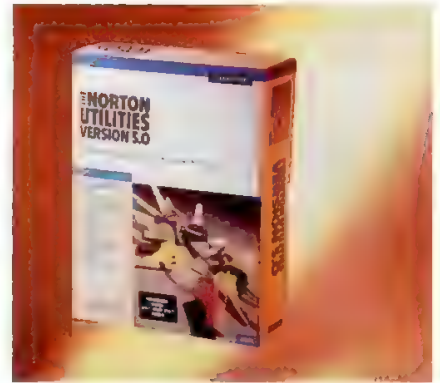
PackRat, Version 3.0

by Carol Levin

Text-retrieval packages, outliners, contact managers and other "almost-PIMs" were once lumped together under the Personal Information Management heading, but over the past three years the term has evolved to imply a very specific set of tools. Among the many PIMs that offer these basic tools, Polaris's \$395 *PackRat* stands out as an admirable, ready-to-run solution. *PackRat* tucks behind a single, unifying interface all the random info-flakes that drift onto your desk and would otherwise accumulate into a pile of procrastination.

Running under *Windows* and using button-controlled list boxes, scroll bars, pop-up dialog boxes, and colorful icons to represent each of the program's facilities, *PackRat* balances three elements to fit users' comfortable patterns of work: structure in scheduling appointments and maintaining contact information, flexibility in creating lists and linking information, and customizability in setting defaults, creating screens, and designing reports. *Agenda* has more functions, but it's harder to use; for its top price (most PIMs range from \$79 to \$395) *PackRat* gives you top performance.

PackRat keeps your daily agenda, with both an audible and visual reminder of appointments; you can set event alerts that will sound in any other application run under *Windows*. It records tasks in a to-do list that you can search by keyword



The Norton Utilities



PackRat

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When you combine Dynamic Data Exchange (DDE) support, which allows you to share information with other Windows-based applications, a comprehensive feature set, and the appeal of the Microsoft Windows interface, you've got a desktop dynamo that can help you cope with data overload.

FACT FILE

PackRat, Version 3.0; Polaris Software, 1820 South Escondido Blvd., #102, Escondido, CA 92025; (619) 743-7800.

List Price: \$395; Network Server Version, \$695 (plus \$150 per node). **Requires:** 1MB RAM, DOS 3.1 or later, Microsoft Windows 3.0.

Reviewed: November 27, 1990, page 414.

CIRCLE 605 ON READER SERVICE CARD

Central Point Software Inc.

PC Tools Deluxe, Version 6.0

by Edward Mendelson

If you don't like to shop, you'll love *PC Tools Deluxe*, Version 6.0. Simply buy a copy of Central Point Software's \$149 utility omnibus, and you may not need to buy anything else for months. You'll already have a complete set of disk and file utilities, plus an overstuffed desktop full of calculators, notepads, outliners, databases, and a telecommunications module—all packed with enough features to keep experts busy, and menu-driven to make things easy for novices.

PC Tools' Shell program lets you view and manipulate files and directories from within a fully customizable window layout. You can add any other applications to the predefined built-in menus and launch

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them directly from the Shell. If you want an application to load a file, just highlight the file in the Shell's directory tree before launching the application. If you run the Shell as a TSR, you can use it as a task switcher. A keystroke lets you jump temporarily from your word processor to the Shell; another keystroke can launch your spreadsheet; and a few more keys let you jump back again to your word processor.

The fast-moving backup program included with *PC Tools* is unique in its ability to access most popular tape drives in addition to floppy disks. *PC Tools'* cache (improved since the first release of 6.0) and defragmenter rival standalone products in flexibility and speed. Its disk repair program doesn't equal the *Norton Utilities* Disk Doctor, but it can repair most of the varieties of damage likely to affect all but the most exotic hard disk configurations.

A package as stuffed with treasures as is *PC Tools* inevitably suffers from inconsistencies. Some of the package's utilities can be run entirely from the command line; others demand that you use menus. You can search for text in the text editor but not in the hex editor. If you don't install the software on drive C:, the utilities sometimes won't know where to look for files they need. The interface works well with a mouse, but often feels awkward when used with the keyboard.

The beauty of *PC Tools Deluxe* is that once you own the package, you may never again encounter a task that you can't perform or a problem that you can't solve using software already installed on your disk. *PC Tools Deluxe* can't do everything—but no other single package does as much.

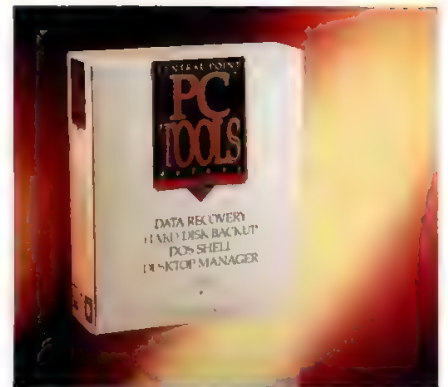
FACT FILE

PC Tools Deluxe, Version 6.0; Central Point Software Inc., 15220 NW Greenbrier Pkwy., #200, Beaverton, OR 97006; (503) 690-8090.

List Price: \$149. **Requires:** 512K RAM, DOS 3.0 or later. Hard disk recommended.

Reviewed: June 12, 1990, page 212.

CIRCLE 606 ON READER SERVICE CARD



Systems that revolutionized the computer industry!

All backed by Northgate® support and service that's unmatched by any other company!

There are a lot of copy-cat "slim-line" systems out there, but don't be confused. These are the ORIGINAL SlimLine systems from the pioneer of this trend-setting technology: Northgate.

In just under a year, SlimLine has become our most popular system. And with good reason. Only SlimLine gives you full 286, 386SX™ and 386™ DX power in a package only 4.25" high and 16.5" square.

Now... four new SlimLine systems! "Northgate for 1991" features a SlimLine family that offers more choice than ever before: SlimLine 286/12, 386SX/16 and 20 MHz.

Our new powerhouse 386/33 rounds out our complete range of systems.

Northgate SlimLine Common Features:

- Small footprint SlimLine case with room for two exposed and one internal half-height devices
- Intel® and Weitek® math coprocessor support
- 150 watt power supply
- Clock/calendar chip rated at five years
- Front mounted reset and high/low speed controls
- MS-DOS 4.01 and GW-BASIC installed
- On-line User's Guide to MS-DOS 4.01
- FCC Class B Certified
- 1 parallel and 2 serial ports
- Built-in VGA video adapter
- Built-in IDE hard drive and floppy disk controllers
- Five open expansion slots (three 16-bit full length, two 8-bit half-length)

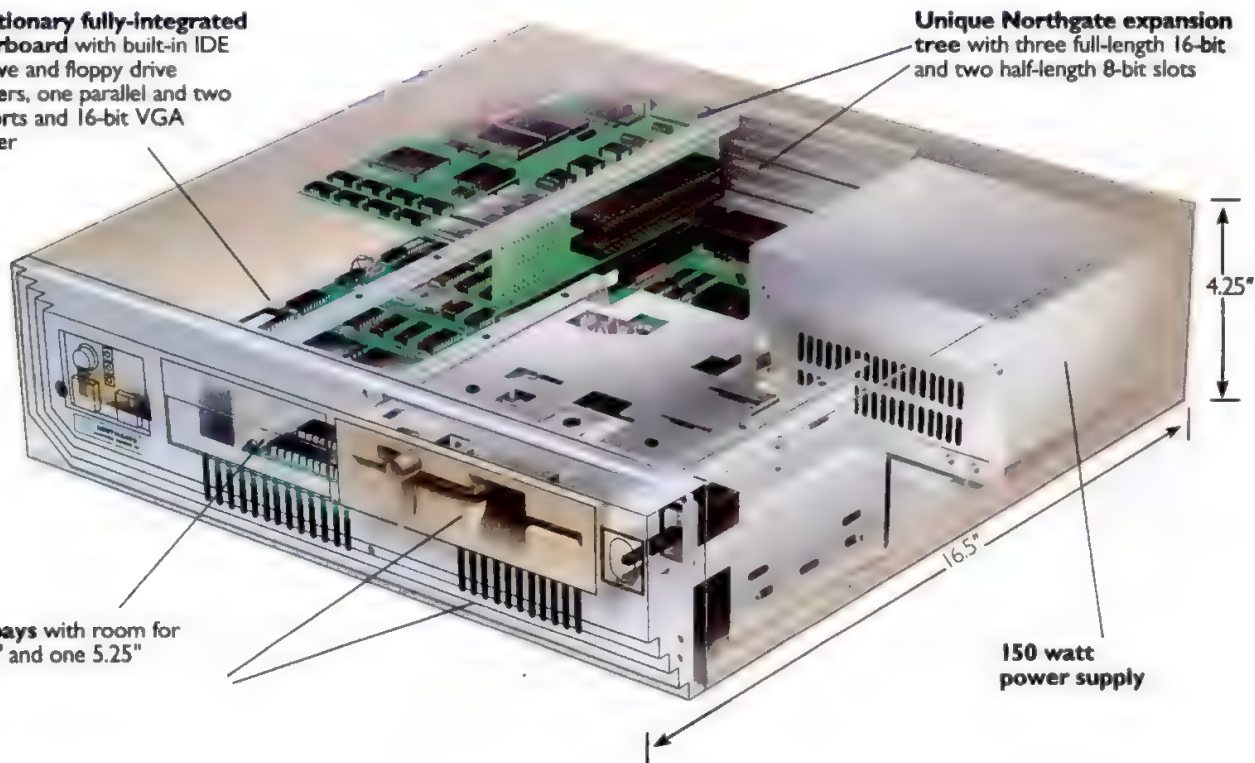
Here's how we put full power into a performance package only 4.25" high!

Revolutionary fully-integrated motherboard with built-in IDE hard drive and floppy drive controllers, one parallel and two serial ports and 16-bit VGA controller

Unique Northgate expansion tree with three full-length 16-bit and two half-length 8-bit slots

Drive bays with room for two 3.5" and one 5.25" device

150 watt power supply



Here they are...the Northgate family of Super SlimLines™.

One format, four sensational systems—take your pick!

NEW! SlimLine 286/12 MHz

Ideal entry level system for use as network terminal or stand alone system for office and home use. Excellent for word processing, simple spreadsheet and light graphics programs.

- Intel® 80286/12 MHz processor
- 1.2Mb and 1.44Mb floppies
- 2Mb of RAM on motherboard
- 12" VGA gray scale monitor
- 40Mb hard drive
- OmniKey® keyboard

\$1699⁰⁰ Or as low as \$60⁰⁰ per month*

NEW! SlimLine 386SX/16 and 20 MHz with 64K cache

No ordinary SX! Northgate engineered these systems with 64K cache memory to allow you to run Microsoft Windows and other 32-bit software at quick cache-enhanced speeds. Handles database management, graphics and spreadsheet applications with ease. Choose 16 or 20 MHz models.

- Intel 80386SX 16 or 20 MHz processor
- 1.2Mb and 1.44Mb floppies
- 2Mb of RAM on motherboard
- 12" VGA gray scale monitor
- 40Mb hard drive
- OmniKey keyboard
- 64K SRAM read/write-back cache
- Microsoft® Windows™ 3.0 and mouse

386SX/16 **\$1999⁰⁰** Or as low as \$70⁰⁰ per month*

386SX/20 **\$2199⁰⁰** Or as low as \$75⁰⁰ per month*

The system that started it all ... SlimLine 386/20 MHz!

SlimLine 386/20 zips through complex spreadsheets, moderate programming needs, desktop publishing and other demanding applications.

- Intel 80386/20 MHz processor
- 12" VGA gray scale monitor
- 4Mb of RAM on motherboard
- Microsoft Windows 3.0 and mouse
- 40Mb hard drive
- 1.2Mb and 1.44Mb floppies
- OmniKey keyboard

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NEW! SlimLine 386/33 MHz powered up with 64K cache!

Now for the first time ever, you can get award-winning Northgate Elegance™ performance in our SlimLine case! SlimLine 386/33 is ideal for speeding through processor-intensive tasks like desktop publishing, CAD/CAM, large database and business programming applications.

- Intel 80386/33 MHz processor
- 1.2Mb and 1.44Mb floppies
- 4Mb of RAM on motherboard
- 12" VGA gray scale monitor
- 64K SRAM read/write-back cache
- Microsoft Windows 3.0 and mouse
- 40Mb hard drive
- OmniKey keyboard

\$2899⁰⁰ Or as low as \$105⁰⁰ per month*



Standard SlimLine Upgrades (Add to the base system price)

Hard Drives	12" Gold Star VGA Gray Scale 640 x 480	Gold Star 14" VGA Color 640 x 480	Panasonic 14" VGA Color 1024 x 768	NEC 3D 14" VGA Color 1024 x 768
10Mb IDE	\$ 0.00	\$ 0.00	\$ 400.00	\$ 450.00
80Mb IDE	\$200.00	\$500.00	\$ 600.00	\$ 850.00
200Mb IDE	\$300.00	\$600.00	\$ 700.00	\$ 950.00
200Mb IDE	\$600.00	\$900.00	\$1000.00	\$1250.00

Call for latest pricing and custom configuration specifications.

"Northgate stops at nothing to please its customers!" PC Magazine Sept. 25, 1990

- NEW 60-Day No-Risk Trial—if you aren't 100% satisfied, return it!
- Free delivery to your office or home.
- Full one year warranty on systems, 5 years on OmniKey keyboards
- Northgate responds to your needs with overnight shipment of parts—at our expense!
- Free on-site service to most locations for one year if we can't solve your needs over the phone.
- Unique 24-hour toll-free technical support—the industry's best!
- For your convenience, we accept VISA, MasterCard and Northgate's Big 'N' card. We offer leasing and financing options, too!

CALL TOLL-FREE 24 HOURS EVERY DAY 800-548-1993

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Northgate® Elegance™...

The industry's highest rated 386™ and 486™ systems!



When we say Northgate manufactures the highest-performing, best-supported computer systems in the world ... it's a fact. Industry experts and customers worldwide agree!

In test after test, Northgate Elegance systems perform flawlessly. After the competition has been put through the same demanding paces, only Elegance 386 and 486 emerge as the winners.

And here's the proof! Northgate has won four *PC Magazine* Editors' Choice Awards, two *Computer Shopper* Best Buy Awards and received *InfoWorld's* Number One and Number Two Products of 1989.

PLUS AT PRESS TIME ... Northgate received word from *Computer Shopper* that Elegance 486/25i won a 1990 Best Buy Award. That makes an unprecedented **FOUR YEARS IN A ROW** Northgate received *Computer Shopper's* prestigious honor!

We'd be fooling ourselves (and underestimating you) if we thought you'd buy based on performance alone. That's why Northgate has a corporate commitment to customer service that's equally impressive. No puffery here...

"...Northgate stops at nothing to please its customers." *PC Magazine* September 25, 1990

- ◆ Free delivery to your office or home.
- ◆ **NEW 60-Day No-Risk Trial!** To serve you better, Northgate has doubled its No-Risk Trial period to 60 days.
- ◆ Full parts and labor warranties: 1 year on systems; 5 years on *OmniKey*® keyboards.
- ◆ Overnight shipment of replacement parts—at our expense.
- ◆ Northgate's unique 24-hour toll-free technical support leads the industry—most needs are met with just one call!
- ◆ Free on-site service to most locations if we can't solve your technical needs over the phone.
- ◆ Northgate makes state-of-the-art power affordable! Charge your purchase to your Big 'N' card, VISA or MasterCard. Ask about financing and leasing options, too!
- ◆ Call Northgate before you decide to buy elsewhere. You'll be amazed at our new low pricing!

"What WordPerfect® is to software support, Northgate is to hardware, and there are even a few things WordPerfect could learn from the folks in Minneapolis."

Bernie Zilbergeld
Bay Area Computer Currents
August 14, 1990

Select desktop or optional vertical power case.

Northgate's elegant desktop case features 5-bays with room for 3 exposed and 2 internal half-height devices. Comes with 200 watt power supply. For greater expansion capabilities, choose our vertical 7-bay powerhouse with a 220 watt power supply.

Northgate Page Mode 386/20 MHz

As a cost-efficient, dependable network file server, Page Mode has no equal. Its reliability is confirmed by Novell® certification and by users of office networks every day. Northgate boosts performance of this 386/20 workhorse through the use of an efficient page mode memory management scheme. Other performance features include:

- ◆ Intel® 80386/20 MHz processor
- ◆ 4Mb of RAM (expandable to 16Mb)
- ◆ 40Mb hard drive
- ◆ 1.44Mb and 1.2Mb floppy drives
- ◆ 16-bit VGA video adapter
- ◆ Eight expansion card slots
- ◆ One parallel and two serial ports
- ◆ MS-DOS 4.01 and GW-BASIC installed
- ◆ Microsoft® Windows™ 3.0 and mouse
- ◆ 14" VGA gray scale monitor
- ◆ OmniKey keyboard
- ◆ FCC Class B Certified

\$2499⁰⁰ Or as low as \$85⁰⁰ per month*

Northgate Elegance 386/486 Common Features:

- ◆ American-made motherboard
- ◆ RAM expansion up to 8Mb on motherboard (16Mb total RAM with 32-bit memory card)
- ◆ 16-bit VGA video adapter
- ◆ One parallel and two serial ports
- ◆ MS-DOS 4.01 and GW-BASIC installed
- ◆ Microsoft® Windows™ 3.0 and mouse
- ◆ FCC Class B Certified

Northgate Elegance 386/25 & 33 MHz

The best in their respective classes! Both are ideally suited for managing large databases (over 1000 records), full-time business accounting, multitasking and other demanding applications.

Northgate gives you a powerful standard configuration including high-speed 64K RAM cache and 4Mb of RAM. Take a look at everything you get:

- ◆ Intel® 80386/25 or 33 MHz processor
- ◆ 4Mb of RAM
- ◆ 40Mb hard drive
- ◆ 64K SRAM read/write-back cache
- ◆ 3.5" 1.44Mb and 5.25" 1.2Mb floppy drives
- ◆ 16-bit VGA adapter
- ◆ 14" VGA gray scale monitor
- ◆ OmniKey keyboard
- ◆ Novell Certified

25 MHz **\$2999⁰⁰**
Or as low as \$105⁰⁰ per month*

33 MHz **\$3299⁰⁰**
Or as low as \$115⁰⁰ per month*



Northgate Elegance 486/25 and NEW 486/33 MHz ISA

In addition to receiving an Editors' Choice and 1990 Computer Shopper Best Buy Award, Elegance 486/25i outscored all competitors in InfoWorld Magazine's 1990 reviews of 486 systems. Elegance "leads the pack by a comfortable margin", they said. "It offers impressive performance, exceptional expandability and it is tops in support and value."†

NOW! Northgate introduces the next generation—Elegance 486/33 ISA. Both systems are ideal for heavy-duty business applications like full time database management, CAD/CAM, financial planning, accounting and programming. Includes:

- ◆ Intel 80486/25 or 33 MHz processor
- ◆ 4Mb of RAM
- ◆ 40Mb hard drive
- ◆ 64K SRAM read/write-back cache
- ◆ 3.5" 1.44Mb and 5.25" 1.2Mb floppy drives
- ◆ 16-bit VGA video adapter
- ◆ 14" VGA gray scale monitor
- ◆ OmniKey keyboard
- ◆ Novell Certified (486/25)

25 MHz **\$5199⁰⁰**
Or as low as \$180⁰⁰ per month*

33 MHz **\$5799⁰⁰**
Or as low as \$200⁰⁰ per month*

Standard Upgrades (Add to the base system price)

Hard Drives	14" NEC VGA Gray Scale 800 x 600	Gold Star 14" VGA Color 640 x 480	Panasonic 14" VGA Color 1024 x 768	NEC 3D 14" VGA Color 1024 x 768
40Mb IDE	\$ 0.00	\$300.00	\$ 400.00	\$ 400.00
80Mb IDE	\$200.00	\$500.00	\$ 600.00	\$ 850.00
160Mb IDE	\$300.00	\$600.00	\$ 700.00	\$ 950.00
200Mb IDE	\$400.00	\$700.00	\$1000.00	\$1250.00

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Replace your "mushy" keyboard with the crisp touch Northgate® OmniKey®!

Look...
12 F-keys
on top AND
LEFT!



OmniKey/ULTRA PC Computing Magazine's Most Valuable Product Of 1990!

PC Computing said: "keyboards don't get any better than this."† And it's no wonder! OmniKey/ULTRA gives you twice the features of ordinary keyboards! You get 12 F-keys on left—PLUS 12 switchable Special Function (SF)-keys on top. And, the greatest touch in keyboards.

See for yourself ... use one for 60-days RISK FREE! If you aren't convinced it's the best, return it. We'll refund every penny!

Look! More exclusive features!

- ALPS click/tactile mechanical key switches
- Interchangeable CTRL, ALT and CAPS LOCK keys
- Switchable right asterisk and backslash keys
- Exclusive period/comma lock key locks out these <>, locks punctuation in
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- Unmatched compatibility with IBM-type systems
- Lifetime quality double-injected keycaps
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Now! ONLY **\$129⁰⁰**
FOB Minneapolis, MN

OmniKey/102 with F-keys on the left

First keyboard to get back to the basics! 12 F-keys on left for fast one-hand combination commands. Readers of *Computer Shopper* named OmniKey/102 their "Best Buy."



- Northgate's original 102 key design
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- Large L-shaped ENTER key with added equals key
- Five year warranty
- 60-day no-risk trial
- Separate inverted T cursor control pad
- Unmatched compatibility with IBM-type systems
- ALPS click/tactile mechanical key switches
- FCC Class B certified

OmniKey/102 ONLY **\$89⁰⁰**
FOB Minneapolis, MN

Inventory Reduction...Quantities Limited!



OmniKey/101
with F-keys
on top and
20% smaller
footprint

- Enhanced 101 key layout
- Interchangeable left CAPS LOCK and CTRL keys
- Calculator-style numeric keypad with added equals key
- Separate inverted T cursor control pad
- ALPS click/tactile mechanical key switches
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- FCC Class B certified
- 10-day no-risk trial
- One year warranty

OmniKey/101-I ONLY **\$69⁰⁰**
FOB Minneapolis, MN

HOURS: Mon. - Fri. 7 a.m. to 12 a.m.; Sat. 8 a.m. to 4 p.m. Central. Dealer and distributor prices available. Se habla español por su conveniencia.

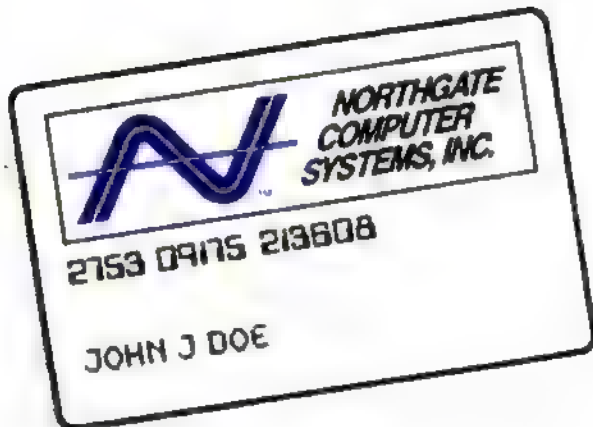
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Fill out and return this form today!

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OPEN YOUR CREDIT CARD ACCOUNT BY FILLING OUT THE APPLICATION BELOW.

Please complete all appropriate sections, providing at least two years residence and employment history. If you are self-employed, please be sure to complete section d. **THIS IS NOT A CREDIT AGREEMENT!** One will be sent to you upon authorization of an account. (This Form Must Be Signed To Process Your Order.) All Financed Purchases Are Subject To Credit Approval. If You Have Any Credit Questions, Please Call For Assistance. Thank You!

A married person may apply for individual credit. I am applying for (check one box, please):

- ☐ JOINT CREDIT with another person. Complete entire application.
☐ INDIVIDUAL CREDIT complete only individual section.
☐ INDIVIDUAL CREDIT but rely on income of another. Complete entire application.

*If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

NOTICE TO WISCONSIN APPLICANTS
 You must disclose your marital status:
☐ married
☐ unmarried
☐ legally separated

a. Personal Information

NAME _____ HOME PHONE (____) _____
 SOCIAL SECURITY NUMBER _____ DATE OF BIRTH ____/____/____
 PRESENT ADDRESS _____ CITY _____ ST _____ ZIP _____
 DATE OF RESIDENCE MO. _____ YR. _____ BUY ☐ RENT ☐ OTHER ☐
 PREVIOUS ADDRESS _____
 EMPLOYER _____ DATE OF EMPLOYMENT MO. _____ YR. _____
 MONTHLY GROSS SALARY \$ _____ BUSINESS PHONE (____) _____
 PREVIOUS EMPLOYER _____ DATES OF EMPLOYMENT _____ TO _____
 Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying the obligation.
 ADDITIONAL MONTHLY INCOME \$ _____ SOURCE _____

b. Credit Information

PLEASE TELL US IF YOU HAVE: CHECKING ACCOUNT (Y/N) _____ SAVINGS ACCOUNT (Y/N) _____
 BANK LOAN (Y/N) _____ HOW MANY? _____ VISA (Y/N) _____ HOW MANY? _____
 MASTERCARD (Y/N) _____ HOW MANY? _____ FINANCE COMPANY LOAN (Y/N) _____ HOW MANY? _____
 DEPT. STORE CHARGE CARD (Y/N) _____ HOW MANY? _____ CREDIT UNION ACCOUNT (Y/N) _____ HOW MANY? _____
 OTHER MAJOR CHARGE CARDS (Y/N) _____ HOW MANY? _____

c. Joint Applicant's Personal Information

JOINT APPLICANT'S NAME _____ HOME PHONE (____) _____
 SOCIAL SECURITY NUMBER _____ DATE OF BIRTH ____/____/____
 ADDRESS _____ CITY _____ ST _____ ZIP _____
 DATE OF RESIDENCE MO. _____ YR. _____
 JOINT APPLICANT'S EMPLOYER _____ DATE OF EMPLOYMENT MO. _____ YR. _____
 MONTHLY GROSS SALARY \$ _____ BUSINESS PHONE (____) _____
 NAME AND ADDRESS OF NEAREST RELATIVE NOT LIVING WITH YOU _____
 RELATIONSHIP _____

d. Self-Employment Information

BUSINESS NAME _____ BUSINESS PHONE (____) _____
 TYPE OF BUSINESS ☐ Proprietorship ☐ Partnership ☐ Corporation IN BUSINESS SINCE _____
 YOUR ANNUAL INCOME FROM BUSINESS Gross \$ _____ Net \$ _____
 PERSONAL BANKER'S NAME _____ BANKER'S PHONE (____) _____

e. Customer Authorization

I authorize Northgate Computer Systems or its assignees to investigate credit records and to report my performance hereunder to credit agencies. I hereby certify that the following information is furnished to you for the purpose of obtaining credit and is true and correct of the best of my knowledge and belief. There are costs associated with the use of this credit card. To obtain more information about these costs, call us at 1-800-548-1993 or write to P.O. Box 59080, Minneapolis, MN 55459-0080.

NY—A consumer credit report may be requested in connection with this application or in connection with updates, renewals or extensions of any credit granted as a result of this application. If I subsequently ask for this information, I will be informed whether or not such a report was requested and, if so, the name and address of the agency that furnished the report.

OH—THE OHIO LAWS AGAINST DISCRIMINATION REQUIRE THAT ALL CREDITORS MAKE CREDIT EQUALLY AVAILABLE TO ALL CREDIT-WORTHY CUSTOMERS AND THAT CREDIT REPORTING AGENCIES MAINTAIN SEPARATE CREDIT HISTORIES ON EACH INDIVIDUAL UPON REQUEST. THE OHIO CIVIL RIGHTS COMMISSION ADMINISTERS COMPLIANCE WITH THIS LAW.

APPLICANT'S SIGNATURE _____ DATE _____

JOINT APPLICANT'S SIGNATURE _____ DATE _____

FOR MARRIED WISCONSIN APPLICANTS:

I acknowledge that the obligation described herein is being incurred in the interest of my marriage or family.

BUYER'S SIGNATURE _____ DATE _____

*This is a credit application. Upon approval, a credit agreement will be sent to you for your signature. This agreement must be signed and returned to activate your account.

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TerraVision Inc.

PHIPS Professional Hi-Resolution Image Processing System, Version 1.4

by Barry Simon

How do you display a 256-color .PCX or TIFF image on a 16-color display or a 16-, 24-, or even 32-bit TARGA file (the latter with a capacity of roughly 4 billion colors) on a 256-color Super VGA system? The answer is color-reduction software.

TerraVision's *PHIPS Professional Hi-Resolution Image Processing System 1.4* is a \$349 program that lets you map more colors to fewer colors, while keeping the image as faithful as possible. It directly reads in TARGA and .TIF images, but you can run a supplied program at the DOS level to convert .PCX, .GIF, Mouse Systems' .PIC, and .VMG files to TARGA files; you then read that TARGA image file in. The program goes through the color reduction process, letting you save images in all the above formats, as well as in Color .EPS.

The algorithms used in the automatic reduction usually produce spectacular-looking images on a 16-color or 256-color display, but if you feel the need to adjust the program's best guess, numerous tools let you do so interactively. For example, you can choose various dithering algorithms or make use of a lovely palette editor. You can also shift the palette to a gray scale that will make your color images suitable for desktop publishing applications. Again, the images can be spectacular.

While *PHIPS* is not a *Windows* application, its proprietary interface has the feel of *Windows*, offering mouse support, dialog boxes, and drop-down menus. For working with reductions to 256 colors, *PHIPS* supports not only the low-resolution IBM VGA but also Super VGAs from Tseng, Paradise, Trident, Video Seven, and Everex. There is also special support if you have a TARGA frame buffer: With that and a Super VGA, you can display the original image on the buffer and the color-reduced image on the VGA.

COVER STORY BEST OF 1990

The bottom line is that if you need color reduction software, you'll want *PHIPS*.

FACT FILE

PHIPS Professional Hi-Resolution Image Processing System, Version 1.4; TerraVision Inc., 2351 College Station Rd., #563, Athens, GA 30605; (404) 769-0330.

List Price: \$349. **Requires:** 640K RAM, EGA or VGA for reductions to 16 colors, MCGA or VGA or supported Super VGAs for 256 colors, 4MB EMS. Hard disk and mouse recommended.

Reviewed: October 30, 1990, page 44.

CIRCLE 607 ON READER SERVICE CARD

LaserTools Corp.

PrintCache, Version 2.3a

by Edward Mendelson

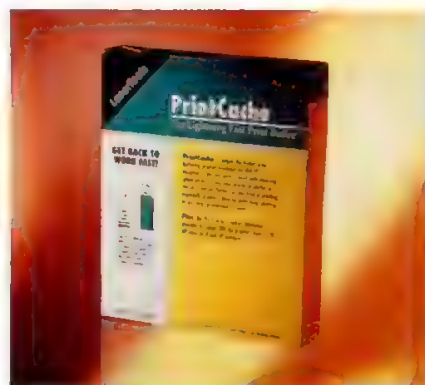
You probably bought a computer because you wanted to get your work done faster, but you find yourself wasting precious minutes staring at the "Please Wait" message your applications display while printing. If you have better things to do with your time, you need a copy of *PrintCache* (formerly *LaserTORQ*). LaserTools Corp.'s \$149 print spooler rushes data from your applications to your printer at speeds that no other software print spooler even approaches.

An application that normally makes you wait 3 minutes while it sends a complex file to the printer will typically make you wait only 15 seconds when you have *PrintCache* installed. Even if your application includes built-in print spooling and returns control of the keyboard to you as soon as you start to print, you normally can't exit the application until printing is complete. Add *PrintCache* to the equation, and you can exit faster.

No other spooler knows *PrintCache*'s time-saving trick of using the printer interrupt to determine when the printer port is ready to receive data. No other spooler automatically installs a device driver and lets you get even faster results by telling your applications to print to that driver instead of wasting time sending data through the BIOS.



PHIPS Professional Hi-Resolution Image Processing System



PrintCache

PrintCache works with any printer technology from daisy wheel to PostScript, but it knows special tricks that enhance LaserJets and DeskJets. The program compresses graphics on the fly to let you print full-page graphics at 300 dots per inch on an HP printer with only 512K of RAM. Without *PrintCache*, you would have to buy more RAM.

Speaking of RAM, *PrintCache* lets you install its buffer in conventional, expanded, or extended memory—or on disk. If you don't use conventional memory, *PrintCache* uses about 16K of DOS RAM, or less than 6K if you dispense with its pop-up menu. You can load *PrintCache* into high memory with 286 and 386 memory managers.

PrintCache is so fast and trouble-free that you may even forget it's loaded—until you see how long it takes to print on anyone else's system.

FACT FILE

PrintCache, Version 2.3a; LaserTools Corp., 1250 45th Street, #100, Emeryville, CA 94608; (800) 767-8004, (415) 420-8777.

List Price: \$149. **Requires:** 5K to 19K RAM, DOS 2.1 or later. **Reviewed:** April 10, 1990, page 43.

CIRCLE 608 ON READER SERVICE CARD

QMS Inc.

QMS-PS 410

by Alfred Poor

PC users who have struggled with the problems of the Macintosh versus the PC, PostScript versus HPPCL, and serial versus parallel versus AppleTalk finally have something to cheer about. It's the new QMS-PS 410, a printer with a \$2,795 list price and a whole lot of smarts.

The PS 410 has three ports—parallel, serial, and AppleTalk—just like many competing PostScript printers. Like other printers, it offers HP LaserJet PCL emulation as a standard feature in addition to true Adobe PostScript. The big difference between the PS-410 and the others is that it requires essentially *no configuration*. All three interface ports are active at the same time. Hook up a PC to the parallel and a Mac to the AppleTalk connectors, and you have instant printer-sharing with zero extra cost.

COVER STORY BEST OF 1990

The smarts don't stop there. Send a PostScript job from the Mac and a PCL job from the PC, and both will print correctly. The printer's controller is intelligent enough to figure out what kind of print stream it is receiving, and interpret it accordingly. You can even send PostScript and PCL jobs from the same computer, and the printer will automatically adjust. QMS offers an optional HPGL interpreter for the printer that also gets selected by the printer on the fly.

The printer is based on the Canon LX print engine, rated at 4 pages per minute. It comes standard with 2MB of memory, with 1MB, 2MB, and 4MB upgrades available. A 16.7-MHz 68020 drives the controller, so it has plenty of power to keep up with complex print jobs. The printer is compatible with Adobe Type 1 downloadable fonts, but you may not need them; QMS goes beyond the standard list of fonts and includes a full 45 font outlines in the controller's ROM.

There are other true PostScript printers with lower list prices, but none match the power and features offered by this one. If you need to share printers among a few computers or want to be able to transparently switch between PostScript and PCL, and if you want all this without the hassle of arcane configuration procedures, the QMS-PS 410 is the way to go.

FACT FILE

QMS-PS 410; QMS Inc., One Magnum Pass, Mobile, AL 36618; (800) 523-2696, (205) 633-4300.

List Price: \$2,795. **Dimensions (HWD):** 7.5 x 26.1 x 13.5 inches. **Weight:** 26 pounds.

Emulations: PostScript, LaserJet IIP.

Reviewed: November 13, 1990, page 251.

CIRCLE 609 ON READER SERVICE CARD

Brightwork Development Inc.

SiteLock, Version 3.0

by Frank J. Derfler, Jr.

A network is a repository of information and resources and is critical to the operation of many organizations. The business of the company often depends on the



QMS-PS 410



SiteLock

names, orders, accounts, and balances that are kept on the network. Administrators need tough tools to protect the files on a network from intentional and unintentional abuse, intrusion, and possible attack by viruses.

SiteLock, a \$495 program marketed by Brightwork Development, is an integrated shield against attack and abuse. It runs as a value-added process (VAP) in *Advanced NetWare 286* servers and as a *NetWare Loadable Module (NLM)* in servers running *NetWare 386*.

The software consists of the network module (VAP/NLM) and the *Watcher* program. You must set aside 150K RAM in your *NetWare* server when using the VAP or NLM module. The NLM also requires an additional 500K RAM for Novell's CLIB/STREAMS library. The memory-resident *Watcher* program runs in each networked PC and requires a paltry 2K of RAM.

The *Watcher* program issues requests to the file server master program. The NLM or VAP processes the requests, checks the authorized number of simultaneous users, ensures the purity of the programs' code (take that, viruses!), and then determines whether the client station will or will not proceed. In accord with the orders it receives, *Watcher* will either allow the program to execute or will terminate it.

SiteLock generates easy-to-follow reports, and the menu-driven interface is easy to navigate. If you're looking for a metering tool that offers good reports and limits the number of users for each application to ensure compliance with site license agreements, take a look at *SiteLock*. As a network administrator, you'll appreciate the protection from both unintentional and intentional harm that the program affords.

FACT FILE

SiteLock, Version 3.0; Brightwork Development Inc., 766 Shrewsbury Ave., Jerral Center West, Tinton Falls, NJ 07724; (800) 552-9876.

List Price: \$495. **Requires:** 120K RAM in *NetWare 286* server or 160K RAM in *NetWare 386* server, 2K RAM in each workstation, *Advanced NetWare 286* or *NetWare 386*, DOS 3.1 or later. **Reviewed:** September 11, 1990, page 317.

CIRCLE 610 ON READER SERVICE CARD

COVER STORY BEST OF 1990

Zenographics

SuperPrint

by Rock Miller

SuperPrint has to be the best thing to come along for your LaserJet since the jumbo font cartridge. A master of many trades, it manages your scalable fonts, improves the quality and speed of your graphics printing, and offers efficient background spooling. Best of all, these many skills come for the reasonable, even modest, cost of \$195.

To the user, *SuperPrint* looks like a substitute printer driver—you simply install it in place of your Hewlett-Packard LaserJet, DeskJet, or compatible printer driver (it also works with the PaintJet), using the *Windows 3.0* Control Panel. Inside, however, it's a sophisticated raster image processor that converts each page into a graphic image before sending it to the printer.

The advantages of this may not be apparent at first. In fact, text printing can even be slower with *SuperPrint* because it sends the entire image of the page to the printer, rather than just the text. But in return, it speeds up graphics printing dramatically because it uses the fast processor in your computer to render the page rather than relying on the slow processor in your printer. Even text-heavy documents can print faster, if they have many fonts.

SuperPrint's independence from your printer has some other benefits. Because it renders gray-scale images itself, it can use more attractive dither patterns than the one your LaserJet supports, with eye-catching results. And because it handles fonts within your computer, you'll never need to wait for fonts to be downloaded to your printer—a real asset in network environments.

Unlike its competitors from Adobe and Bitstream, *SuperPrint* lets you use just about any type of scalable font. You can mix and match Adobe Type 1, Bitstream Fontware, Bitstream Speedo, Compu-



SuperPrint

graphic Intellifont, or The Company's Numbus Q fonts (in addition to the full range of HP soft fonts), generating them beforehand or on-the-fly as needed. The program generates matching Windows screen fonts at the same time.

As if all this weren't enough, *SuperPrint* also comes with SuperQueue, a substitute for Windows 3.0's abysmally slow Print Manager. SuperQueue stores the spool files in an efficient compressed format and returns control to the foreground task relatively quickly. It even lets you print pages in reverse order, which is handy if you have an older LaserJet whose paper-feeding mechanism doesn't do this for you already.

If you use a LaserJet with Windows 3.0, you won't want to be without *SuperPrint*.

FACT FILE

SuperPrint; Zenographics, Four Executive Circle, #200, Irvine, CA 92714; (714) 851-6352.

List Price: \$195. **Requires:** Microsoft Windows 3.0; CalComp, Tektronix, or Hewlett-Packard LaserJet, DeskJet, or PaintJet printers or compatibles. **Reviewed:** September 25, 1990, page 33.

CIRCLE 611 ON READER SERVICE CARD

Vocal Technologies Ltd.

Stowaway 2400

by Alfred Poor

The Stowaway 2400 from Vocal Technologies solves a nagging problem about traveling with a laptop or notebook computer: the modem.

Okay, so maybe you haven't discovered yet that modems are a problem, but plenty of other people have discovered that they sure can be. Often, it's simply quicker and more convenient to rely on your portable's battery power for telecomputing, even with an AC outlet available. Unfortunately, internal modems draw precious power from your portable's batteries, and most external pocket modems use batteries that run down quickly, so you have to carry spares. Standard external modems are bulky and heavy, and require accessing the power outlet you're trying to avoid. The Stowaway 2400—which operates at 2,400 bits per second—is a compact 2.2- by 3- by 0.8-

COVER STORY BEST OF 1990

inch (HWD) package that weighs just 2.2 ounces and comes with a list price of \$295. It is even more remarkable for what it does not have: no power connection and no battery. Yet it magically does not draw power from your portable.

How does the Stowaway achieve this small miracle? It gets all the power it needs right from the telephone line. That may seem like a strange notion at first, but it's no different from your typical home telephone—the latter also has lots of intelligence but does not require any external power aside from that provided by the telephone line.

The Stowaway responds to the Hayes AT command set and has all the features you would expect: nonvolatile configuration memory, auto-answer, and automatic fallback to slower transmission speeds. There are two connectors—a 25-pin serial connector and an RJ-11 jack for the phone line. If your laptop has a 9-pin connector (as is most often the case) you will have to add a 9- to 25-pin adapter or pigtail cable to your travel kit, but this inconvenience is small compared with running out of battery power.

The Stowaway has been improved in the time since we originally reviewed it: Vocal Technologies has added two indicator lights so that you can now monitor the petite modem's status during a call, which can make troubleshooting a far easier task.

The Stowaway makes it as convenient to communicate as it is to compute with your portable when you're away from your home base. This modem is so small and simple, however, that you might even be tempted to use it with your desktop computer. ■

FACT FILE

Stowaway 2400; Vocal Technologies Ltd., 3032 Scott Blvd., Santa Clara, CA 95054; (203) 356-1837.

List Price: \$295 (1,200-bps model, \$195).

Dimensions (HWD): 2.2 x 3 x 0.8 inches.

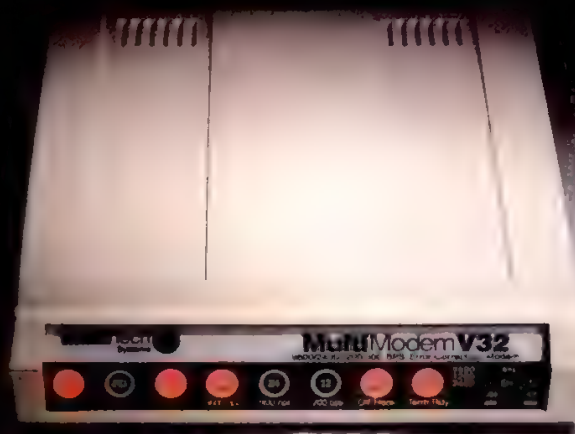
Weight: 2.2 ounces. **Reviewed:** June 12, 1990, page 48.

CIRCLE 612 ON READER SERVICE CARD



Stowaway 2400

WHAT YOU SEE



WHAT YOU GET

There's a lot more to Multi-Tech's new V32 modem than meets the eye.

You'll get all of the modern features that you need to up your performance while lowering your costs.

The versatile MultiModem V32 gives you transmission speeds from 300 to 9600 bps. Completely upward and downward compatible with the V.32, V.22bis, 212A, V.22, V.21 and 103 standards, the MultiModem V32 automatically recognizes and matches speeds and protocols. There's V.42 and MNP® error correction too, as well as remote configuration, callback security and more.

You'll also get the new CCITT V.42bis data compression (as well as MNP® Class 5), allowing the MultiModem V32 to achieve throughputs approaching 38,400 bps. And the MultiModem V32L gives you dial-up and 4-wire leased line operation, with automatic dial back-up.

You can get the top-rated MultiModem V32 in desktop, internal and rack-mounted versions. You'll also get toll-free technical support that is second to none.

The closer you look at Multi-Tech, the more you'll like what you see. And with complementary products such as multiplexers, 3270/3780 emulators, and LAN adapters, hubs and gateways, you'll like what you get.



MultiTech
Systems 

The right answer every time

Multi-Tech Systems, Inc.
2205 Woodale Drive
Mounds View, Minnesota 55112 U.S.A.
(612) 785-3500 (800) 328-9717
U.S. FAX (612) 785-9874
International Telex 4998372 MLTTC
International FAX (612) 331-3180
CIRCLE 144 ON READER SERVICE CARD

COVER STORY
**ABORT, RETRY,
FAIL?**
SPECIAL EDITION

ABORT, RETRY, FAIL?

A special bonus edition of *Abort, Retry, Fail?* to salute the people, places, and advertising that made 1990 a memorable year.



"YOU'D BETTER GET OUT HERE—ONE OF THE LINKS IN THE NETWORK IS STARTING TO ACT UP."

Spends Less Time Retrieving Lost Files?

A secretary gains seven pounds in the year switching from a typewriter to a computer, because he or she spends less time typing and retrieving files, according to University of Pennsylvania psychologist Thomas Wadden.

Flash! Computer Virus Strikes Libby, Montana

"Ripley said the [county library] computers could still be operated as long as the machines weren't turned off and as long as the person operating a computer used a complicated system of going into warm boot to use the control-out delete command to bypass one of the bio files.

"Even now, Ripley said, she isn't exactly sure how she got rid of the virus, but she believes she formatted the mother board, which is the main memory board.

"In any case, the process—which took Ripley four hours—left the machines healthy and virus-free."

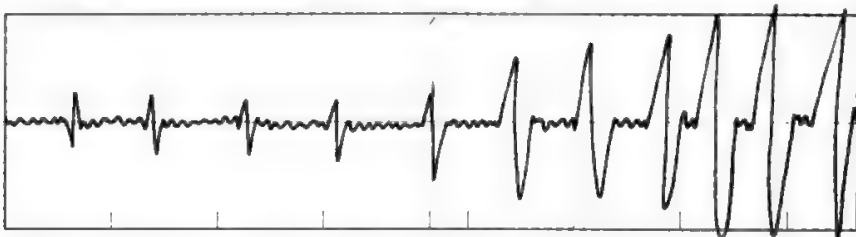
—*The Western News*, Libby, Mont., November 30, 1988



Use either setting when testing lawyers? According to this test-equipment ad by Columbus Instruments of Ohio, this is a general-purpose device that "can be used in human as well as animal research applications."

CARDIAC OUTPUT COMPUTER+ IBM-PC FOR HUMANS AND RATS

CARDIOMAX plus an IBM-PC Computer measures, prints on printer and stores on disk for future recall: *Cardiac Output *Stroke Volume *Heart Rate *Systolic, Diastolic, Mean Blood Pressures *Blood and Injectate Temperatures *Graphic pictures of Dilution Curve *Blood Pressure, dP/dt, and ECG Waveforms *Calculates and Prints Dilution Curves *Appearance, Elevation, Mean Concentration and Mean Dilution Times.



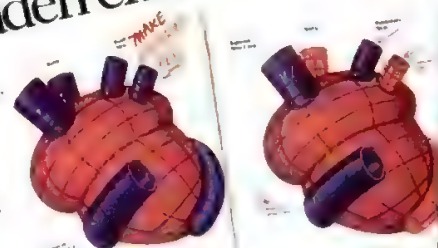
This is what typically happens to people about minutes into a 1-2-3/G product demo.



Lotus 1-2-3/G not only elevates your analytical powers, it causes your heart to beat in reverse.

NEC's ad for its Colormate PS printer could stand a third change of heart: Blood in the pulmonary artery is unoxygenated (blue) blood on its way to the lungs to become oxygenated, while blood in the pulmonary vein is oxygenated (red) blood returning from the lungs for distribution to the body. The correct color scheme should actually be the opposite: pulmonary vein red, pulmonary artery blue.

Let's say you have a sudden change of heart

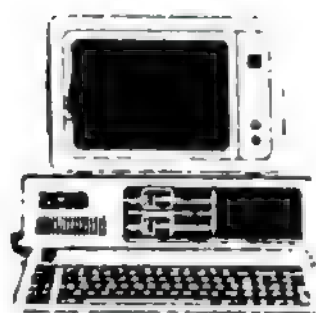


Hypothetical situation: You suddenly realize that key parts of your diagram need to be more clearly defined. And your presentation is in less than an hour.

High-Tech-Transfer Crackdown

"Western export controls bar most U.S. technology products from Eastern Europe. Among equipment that can't be shipped without a special license: Personal computers able to process more than 78 bits of data per second—a rate roughly equal to that of Intel Corp.'s 80286 microprocessor."—*San Jose Mercury News*, Saturday, February 17, 1990

HOUSTON'S ONLY AUTHORIZED CLONE DEALER



- All Configurations
- We Customize Machines!
- Hardware Upgrades
- Best Support
- Mail Order Prices!
- Your Best Choice

COMPUTER QUEST

789-8811
3026 Chimney Rock

Who's to argue: Computer Quest claims to be Houston's only authorized clone dealer.



Man gets 10 years for attacking PC

Read further and you'll find the victim was a police constable, according to Hong Kong's *South China Morning Post*, June 2, 1990.

Unfortunately Not Interchangeable with The Brake Drum in Your Laser Printer

"Lightweight, portable copiers are particularly useful for satellite offices, interoffice use and work at home. Using microcartridges that house brake drum, developer and toner, these units can feed 500 copies without reloading. Some provide color (usually black, red, brown, green, blue or light blue)." —*Office Systems 90*, January, 1990

LETTER TO DATABASE

Escaping 'Frilly 13th'

Sir: I have never taken seriously your articles about a software virus do- ing the rounds in these parts. I therefore com- pletely ignored your warning (*Post Database*, Oct 11) that one of these nasty virus programs was due to raise its ugly head on Friday, October 13. How right was! I am glad that I did not waste my time in taking the precautions that were ad- vocated with dkjgr wehfu

akliu4def xyz3fglqwerty
kshfgu 87jfbw7&*
??dktivnsd0 fkenkfiwen
kfdnrhdy — and
bo\$grcks to you.

I am happy to advise that my PC has escaped the virus that you predict- ed might affect us com- puter buffs on Frilly, Oc- topus 13. You really shouldn't frighten us out of our wits.

Yours runcibly,
Roy Hudson
Chiang Mai

Who knows where the Friday the 13th Virus strikes next? Letter to the computer column section of the *Bangkok (Thailand) Post* newspaper, October 1989.

Faint Praise for the 8-Bit Quarterback

"Everybody who watched [quarterback] Chris Chandler grow up in Everett knew he was going to be a superb athlete. He could play any sport well. He would turn teeth brushing into competition, just so he had a chance to win. By the time he concentrated on football at the University of Washington, the college football world discovered he had a cannon hanging from his right shoulder and an Apple II atop his neck." —*Seattle Post-Intelligencer*, May 3, 1990

User-friendly birth control, funding urged

CHICAGO (AP) — The nation needs "user-friendly" birth control methods to reduce its 4 million

Computer jargon invades the outside world: Headline from the *Daily Courier-News*, Chicago, January 30, 1990



WIN AN INFINITI FROM LEXIS.



The LEXIS Infiniti Sweepstakes is your chance to win the new luxury car that's already made quite a name for itself: the Infiniti Q45. You can win simply by conducting a search on the LEXIS service. In fact, every time you search between April 1 and June 30, 1990, you're automatically entered in the Sweepstakes. And if you win, your firm and the school of your choice win, too. We'll give

each of them a new LEXIS 2000 workstation, the high power system for the 90's. Of course, the real winner is your client. Because when you search on the LEXIS service, you're using the most current and comprehensive body of law and law-related material online today. Now more than ever, it's the power to win. **LEXIS** The Power to Win.

Unable to prevent Toyota from using the sound-alike name Lexus, Mead Data Central's Lexis legal database opted to promote the competition. Users of Mead's on-line database received a chance to win a Nissan-made Infiniti Q45. "Just coincidence that we chose to award an Infiniti," Lexis officials said.

Ad for Black & Decker food processor from Bartell Drugs, Seattle, WA, as printed in the *Seattle Post-Intelligencer*.



NEW SPECIAL EFFECTS, 256 ON-SCREEN COLORS, SPLIT SCREEN, 3-D SHADOWS AND MORE...

Images So Vibrant, They'll Jump Out Of The Screen, Grab You By The Eyeballs—And Pull You In.

THE ULTIMATE GRAPHICS

SEQUENT PRESENTS

Winner of the *PC Magazine* first-annual Drew Alan Kaplan/Thunder Lizard headline-writing contest: TigerSoftware winter 1989 catalog, Coral Gables, Florida. (The product: *PC Paintbrush IV*.)

FLEXSCAN 9070 on Hi-Res Cards. Makes you twice effective.

Flier for Nanao's Flexscan 9070 multiscanning monitor promises "improvements that will give you the professional edge which is the return of a good investment."

DDE Defined in Human Terms

"For example, a graphic created in Corel Draw and pasted into a Pagemaker document could be instantly updated as soon as it was modified in the creator application. 'Right now, it requires carnal knowledge of the other application,' Taniguchi added.'"—*Infoworld*, January 22, 1990

The Memory Limits of DOS. As software applications like word processors, databases, and spreadsheets have become more powerful and productive, they have become more money-hungry as well.

Truth in advertising from the TigerSoftware spring 1990 catalog: Over the past year, the average street price of major word processors has crept up from approximately \$200 to \$300.

1990 All-Name Team

Son of a Batch, a batch file enhancer and compiler from hyperkinetix, Inc.

Stay ahead of the competition... with **NEWTORK WORLD**

BREAKING NEWS: Breaking news, insights into user strategies and trend/analysis stories designed to help you stay on top of the networking world.

Flier for *Network World*, an IDG newsweekly.

DATENSICHERHEIT!



"It doesn't work that way," proclaims a data security ad in *PC Magazin*, Germany.



For \$895, total world domination? Solus Systems Inc.'s Personal Control Computer monitors information from up to 36 events such as temperature, humidity, or vibration and in response toggles switches, alarms, or motors.

Bug Fix of the Year (Blame It on Static Electricity)

Letter to users from Diplomat Software:

"A fellow user has informed Diplomat Software, Inc. that the above referenced file, 'RUSSIAN.NLQ', contains an error in the Russian character set. In reviewing, it has been determined that a static charge might have been the source of this problem. This problem will be evident when printing to a 9-pin dot matrix printer after initialization with the command 'NLQDVR'. Then, only the English characters will print correctly. Enclosed is a diskette that contains the file 'RUSSIAN.NLQ'. Please delete your current copy of that file and replace it with the enclosed copy. We apologize for any inconvenience that might have incurred while printing your Russian text to your 9-pin dot matrix printer."

Honesty in advertising: Bourbaki Inc.'s Fractools (\$59), a fractal image generator. The ad correctly concludes: "They would have killed for this in the Sixties."



Decorator touch: Faux marble base adds the finishing complement to the Viva Modem 24 2,400-bps modem.



One-room schoolhouse? Sault College, Chapeau, Ontario, offered these as separate courses.

LEARN TO COOK WILD MEAT BE A DEFENSIVE DRIVER LEARN LOTUS 1-2-3

Registrations are still being taken for the following courses (up to the Wednesday before start-up):

The Art of Cooking Wild Meat

Friday, November 4, 7:00 - 10:00 p.m.

Saturday, November 5, 9:00 - 5:00 p.m.

United Church Hall

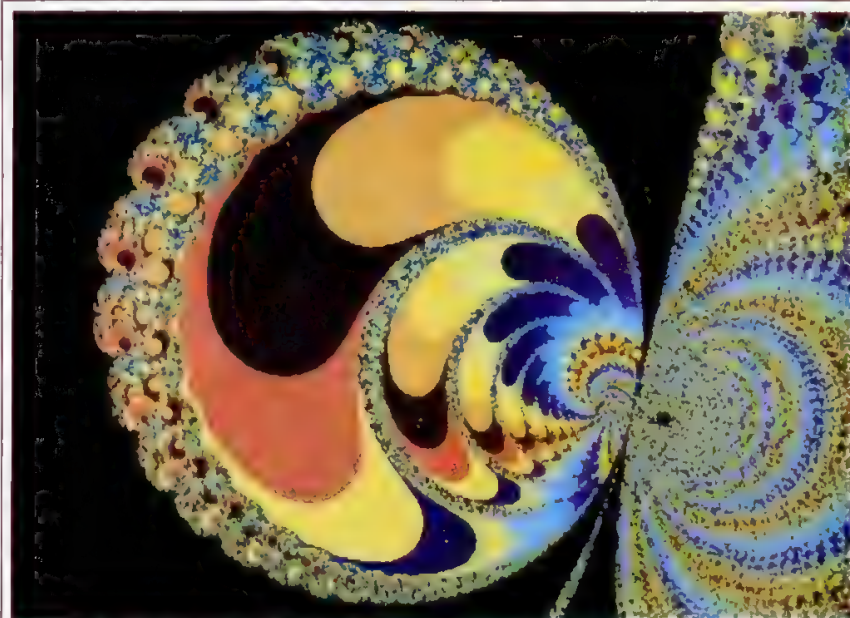
\$15.00

Lotus 1-2-3 Intermediate

Friday, November 4, 7:00 - 10:00 p.m.

Saturday, November 5, 9:00 - 4:00 p.m.

Sunday



REDUCE PRODUCTIVITY

COVER STORY
ABORT, RETRY,
FAIL?

SPECIAL EDITION

Just for puns? Last year it was "Just the fax" headlines that were all the rage. This year, "Take the bus" is all the rage.

286 Computers Are Where Its AT

286-based AT-compatible computers offer the best price/performance ratio of any computer system on the market to date.

PC Today, April 1990

DEC hops buses

Digital Equipment Corp. last week announced its new VAX-4000 bus architecture.

ComputerWorld, January 22, 1990

CATCHING THE PC BUS

PC Today, April 1990

IBM MCA Bus Surpasses AT-Style As Top-Choice Architecture



Percentage of Corporate Managers Surveyed Who Are "Very Likely" To Buy:

- IBM MCA-bus PS/2s 48%
- AT-style, or ISA, PCs 41%

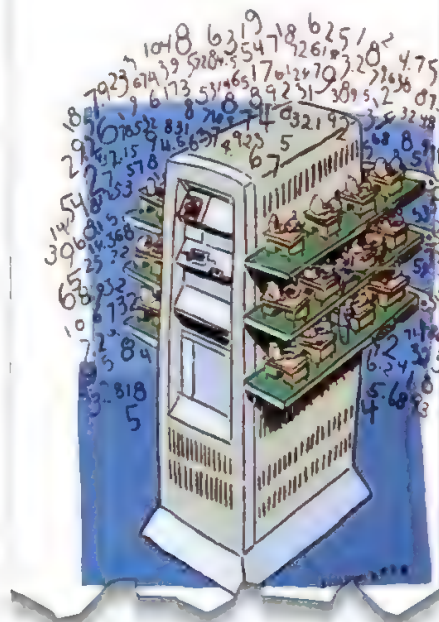
PC Week, January 22, 1990

Missing the bus

ComputerWorld, February 26, 1990

PS/2s Take New RISCs

But MCA Bus Masters Still Lag



PC World, February 1990

BRITANNICA
SOFTWARE

JUST THE FAX

100% Compatible
with all dot matrix
and laser printers!



Send
your fax
to
us
now!



Pun intended: Britannica Software's *Just the Fax* (\$34.95), a series of templates, borders, and clip art to produce cover sheets for the office fax machine.

Press Releases We Didn't Quite Finish Reading

"Dear ISDN Industry Observer:

"Some people have told us that Layer Three subnet software for the Integrated Services Digital Network is not an end-user issue. We disagree. Enclosed you will find two news releases that will greatly affect end-user ISDN capabilities. . . ."

"Look for more announcements from us on these topics in the future."

—Advanced Micro Devices



PC Magazine gives you \$50 and a free PC Magazine T-shirt if we use your submission in Abort, Retry, Fail? Winners this issue: Bill Howard (spends less time), A.J. Pajas (virus), Larry Weight (change of heart), Josh Spin (Lotus heartbeat), Tom Lawford (PC for humans and rats), David M. Ng (78 bits per second), Andy Galewsky (authorized clone dealer), Bill Howard (Apple II atop neck), Ron Barak (Escaping Frilly 13th), Stephen E. Uhrig (copier brake drum), Clinton W. Botkin (PC attacker), David C. Swanson (user-friendly birth control), Glenn Whitten (lady mud wrestlers), James S. Russell (grab you by the eyeballs), Andrew Nicolas (handy shortcut micro-processor), Edward C. Saltzberg (Infinitt from Lexis), Ralph Scharinger (makes you twice effective), Paul M. Bader (carnal knowledge), Joel Bresler (Newtork World), Bill Howard (son of a batch), Thomas Hudock (more money hungry), Bob Dunmire (Datensicherheit), Ross Paviac (monitor and control the world), Abe Roemer (bug fix of the year), Bill Howard (reduce productivity), Ron Champion (Sault College courses), David Morris (PS/2's take new RISCs), Robert Gross (CRT cleaner), Gus Venditto (DCA Windows).



Directions on back of L&M CRT cleaner:
"Apply to clean, dry surfaces."



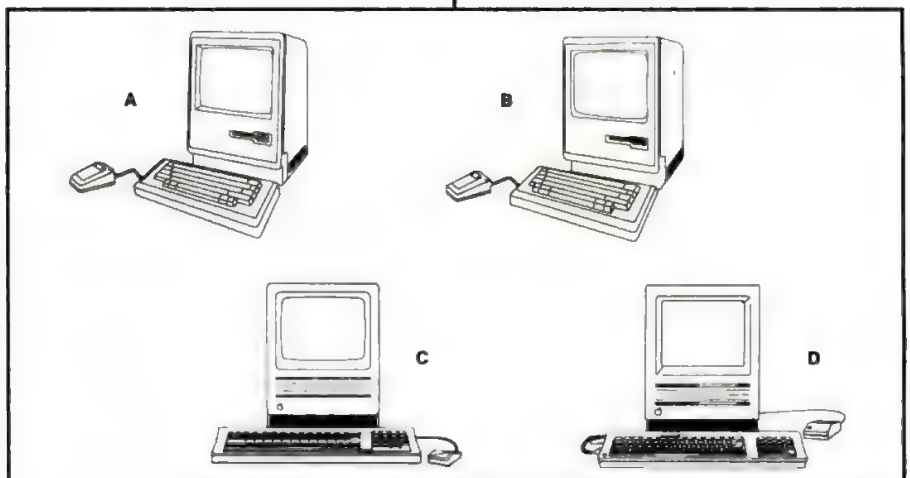
Most memorable press release of 1990, from DCA. It had to do (surprise!) with the May 22 Microsoft Windows 3.0 announcement.

Tax Advice from the Experts

From Jerry Pournelle's April 2, 1990 "A User's View" column in *Infoworld*. Income averaging has not been a part of the U.S. tax code since the Tax Reform Act of 1986:

"You can also use Macintax to experiment. Want to see what your taxes would be if you and your wife filed separate returns? No problem. Want to try income averaging? That's never easy, but it's a lot simpler with Macintax than doing it by hand. . . . Taxes will never be fun, but with Macintax, the worst headaches are removed."

Computer Support Corp., maker of *Diagram* and *Arts & Letters*, charged Software Publishing Corp. ripped off more than 200 copyrighted Computer Support Corp. clip-art images and incorporated them into SPC's *Harvard Graphics*. Software Publishing argued in court papers that CSC's clip art isn't entitled to copyright protection. Right, laser printer clip-art from Computer Support Corp. (A) and Software Publishing Corp. (B), plus images from two other programs, 3G Graphic's *Images with Impact!* and T/Maker Co.'s *Click Art Series*.



Great Teams



Top, left to right: Amelia Earhart and her Lockheed Vega; Sherlock Holmes and Doctor Watson; Orville and Wilbur Wright. Bottom, left to right: Bonnie Parker and Clyde Barrow; PrinTools and Hewlett-Packard Printers; 1980 American Olympic hockey team.

Introducing Another Great Team: PrinTools and Your HP Printer

Now with PrinTools you can have the latest advancements in printer utilities for HP's LaserJet, DeskJet and other compatible printers in one complete set. No more separate utilities because PrinTools includes high-speed spooling, laser printer initialization, file capture of print output, screen dump, HP-GL/2 support and an on-line help facility for HP printers.

So maximize your printer's capabilities and team up with PrinTools, the only software with six printing utilities for the price of one. See your HP dealer, software retailer or call us at 800.825.4115 for further information on the new Great Team.

CIRCLE 167 ON READER SERVICE CARD

PrinTools is a registered trademark of Insight Development Corporation.
Hewlett-Packard, HP LaserJet and DeskJet are registered trademarks of Hewlett-Packard Company.
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 **INSIGHT
DEVELOPMENT
CORPORATION**
Helping you get more from your printer

TOP OF THE MARK.

So what do you get by paying the extra mark-up for a Compaq?

Not a better computer. Dell's new 386™ systems are as fast, expandable and compatible as Compaq's.

Not better service. In 8 straight PC Week polls of corporate customers, Dell's service rated much higher than everyone else's.



The new Dell 33 MHz and 25 MHz 386 computers. Systems include: VGA Color Plus Monitor, 100 MB hard drive, 4 MB RAM.

Not better personal attention. From the moment

you first call us, and for as long as you own your computer, we'll work with you custom configuring your

get. Not only is it 33% faster than the Dell 325D, it has a 64 KB SRAM cache for an extra kick in performance.

We design every machine to our specs, then build it to yours. We design our computers; we know

TO ORDER, CALL
800-284-1210

HOURS: 6 AM-9 PM CT M-F 8 AM-4 PM CT SAT

IN CANADA, CALL 800-387-5752

computer and answering any questions—no matter how small—whether it be technical, sales or service related.

In fact, the only extra you get is, well, mark-up.

Our new 386's pull a fast one on pricier computers. Both the 33 MHz Dell System® 333D and 25 MHz Dell System 325D are faster and more expandable than most higher priced systems.

The new Dell® 325D is a fast, reliable machine with up to 16 MB of RAM on the system board and a 32 KB cache designed into a compact footprint.

The new Dell 333D is as good as a 386 PC can

THE NEW DELL SYSTEM 333D 33 MHz 386 AND THE NEW DELL SYSTEM 325D 25 MHz 386.

STANDARD FEATURES:

- Intel® 80386 microprocessor running at 33 MHz (333D) or 25 MHz (325D).
- Page mode interleaved memory architecture.
- Standard 1 MB of RAM,* optional 2 MB or 4 MB of RAM expandable to 16 MB on system board.
- Integrated VGA controller with 1024 x 768 support.
- Integrated hard drive and diskette drive interface.
- 64 KB (333D) or 32 KB (325D) SRAM cache.
- SmartVu Advanced System Diagnostic Display.
- Socket for Intel 80387 or WETEK 3167 math coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.

- 6 industry standard expansion slots (five 16-bit, one 8-bit).
- High-performance IDE (40 MB, 80 MB, 100 MB, 190 MB) and ESDI (330 MB, 650 MB) hard disk drives.
- 1 parallel port, 2 serial ports, PS/2 compatible mouse port, all integrated.
- 177 watt power supply.
- 12-month Xerox® On-Site Service Contract.

	333D	325D
40 MB VGA Color Plus System	\$3,599	\$2,999

Prices listed include 1 MB of RAM,* 80, 100, 190, 330 and 650 MB hard drive configurations also available.

AD CODE 11893

*Performance Enhancements: Within the first megabyte of memory 96 KB is reserved for use by the system to enhance performance. Can be optionally disabled. All systems are photographed with optional extras. All prices and specifications are subject to change without notice. Dell cannot be responsible for errors in typography or photography. (Source: From Compaq October 15, 1990 press release.

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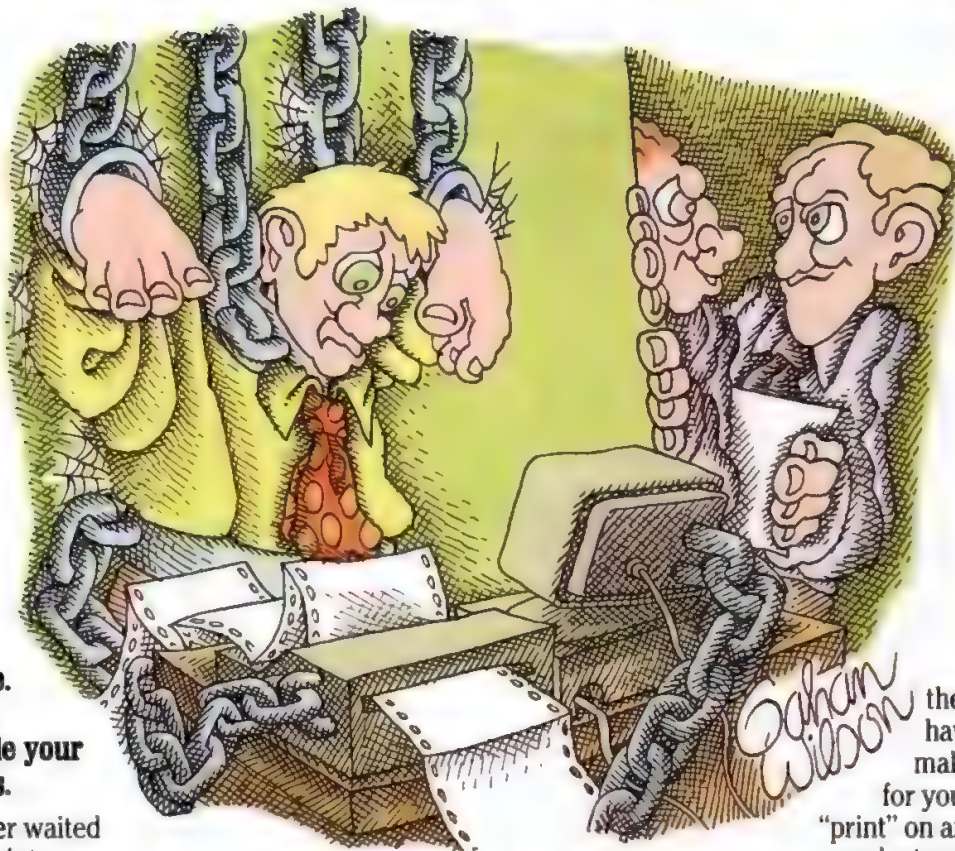
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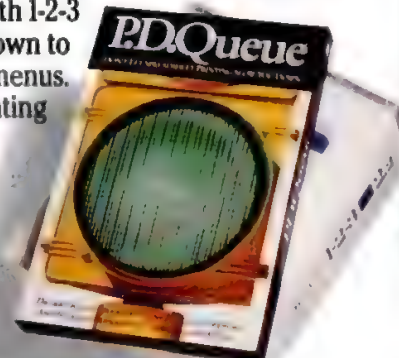
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33-MHz 386s

At the Peak of Their Careers

386/33s have evolved from the fastest and most expensive systems to today's top-end workhorse computers. They're still powerful—but selling for about half of their original prices.

BY BILL O'BRIEN

This issue marks *PC Magazine's* fourth evaluation of 33-MHz 80386DX computers in the last 14 months. In that time, these systems—and our perceptions of them—have gone through some important changes. A look back at the comments and prognostications from our previous roundups is a study in the evolution of a computing genre.

In general, the course of any processor class and the computers based on it follows a very regular pattern. Systems incorporating the latest microprocessor initially explode onto the scene, hailed as the new powerhouses of computing performance and tied to price tags that match their stellar positions. The first 33-MHz 80386s on the market were no exception. In the October 31, 1989, issue of *PC Magazine*, we looked at 22 33-MHz 386s ("High-rise Computing: 22 Powerhouse PCs Top Off at 33 MHz"), which we referred to as "the fastest, most expensive desktop computers you can buy." The standard configuration included 4MB of RAM, at least a 100MB hard disk, an 80387 math coprocessor, and a VGA display subsystem. The average system price was a heart-stopping \$8,800; compare that with the \$3,000 to \$5,000 prices of early 80286 machines.



As time passes, the technology loses some of its sheen. Yesterday's powerhouse becomes today's workhorse or the "midrange desktop computer," as John Dickinson also foresaw in that first 33-MHz 80386 roundup. During this phase of the product's life, manufacturers spend their days tweaking little things like motherboards and BIOS algorithms, substituting 25-nanosecond cache SRAM for the 20-ns. devices first used, and swapping 80-ns. system RAM for the lightning-fast 70-ns. chips reviewers raved about.

None of these changes seriously depletes the performance potential of the machine, but each does allow for certain concessions in pricing. Even a 5-ns. drop in

the speed of cache SRAM can cut several hundred dollars from the list price of a computer, while depriving it of less than 1 percent of its previous performance.

PC Magazine's first peek at the rising edge of this second phase came in surprisingly short order just three and a half months later ("Speed to Burn: 22 of the Fastest 386s," February 13, 1990). Contributing editor Alfred Poor pegged this gathering of 22 machines as "top-end workhorses" finding their place in CAD, desktop publishing, and LAN database activity.

For that round, vendors became enam-

ored of caching disk controllers and hinted at awesome motherboard memory capacities once 4MB SIMMs became available in quantity. The latter promise remains unfulfilled. Still, with these substitutions and tweaks just beginning, the average system price in that issue fell to a more subdued \$6,900.

GAINING A FOOTHOLD

A year in the life of the average computer system can bring it to the brink of oblivion or give it a solid foothold in the marketplace. During the ten months between the second and third looks at 33-MHz 80386 computers ("33-MHz 386 Computers: Mainstream Machines," December 25, 1990), more than 45 new vendors entered this market.

Gone from this roundup of computers were the exotic caching disk controllers, now relegated to "optionally available" status, as *PC Magazine* removed them from the standard computer configuration and vendors found less-expensive buffered controllers with 32K of read-ahead memory. And in many cases, they were attached directly to 3.5-inch IDE drives rather than the hulking full-height or even the more-petite half-height devices that had dominated the territory. *PC Magazine* raised the disk ante on these machines to 150MB, but, even so, the average price had fallen to \$5,207. Nine computers were still in the \$7,500 to \$12,000 range, but we felt confident in classifying the genre as "practical business machines in today's market."

REVIEW CRITERIA

PC Magazine's fourth look at 33-MHz 80386 computers includes systems from Amax, Arche, Austin, Blackship, Boss, Bus, Club AT, Dataworld, Dell, Destiny, Digital, DTK, Dyna Micro, Everex, Gateway 2000, Micro Express, National Micro Systems, PC Brand, PC Craft, Polywell, Spear, Tandy, Tangent, Tri-Star, Zeos, and Zodiac.

Most of these names will be familiar to you from one of the prior issues. Of the 26 companies, only four—Arche, Dell, Digital, and Tandy—have not had a 386/33 reviewed by *PC Magazine* before. They were included because they are the newest entries in this class. The remaining 22 machines were selected from among past participants because they have undergone significant changes that include either a new motherboard, a new system BIOS, or a revamped processor RAM cache design. While hard disks and video cards can aug-



EDITOR'S CHOICE

- Dell System 333D
- Zeos 386-33

Dell and Zeos join the ranks of the Acer 1100/33, Compaq Deskpro 386/33, CompuAdd 333T, and Northgate Elegance 386/33, all Editors' Choice winners in this crowded category over the past year. Unlike some of their predecessors, however, the Dell System 333D and Zeos 386-33 show that you needn't be among the most expensive to be the best.

A latecomer to the 386/33 arena, Dell Computer Corp. proves that its machine was worth the wait. The System 333D locates its video, I/O, and drive controllers directly on the motherboard, which in turn is packaged within a beautifully compact case. This machine has everything on its side: a clean internal layout, vast capabilities, and a \$4,918 price tag that marks Dell's return to the middle ground. Dell proved itself a serious contender in this market by designing the System 333D's motherboard from scratch, and the result is a sophisticated system unlike any we've seen in this crop.

Equally deserving of this award is the Zeos 386-33 with its superior combination of performance, expandability, and price. Zeos International designed this machine for speed—and came up with a system that topped four of our benchmark tests and excelled on the remaining ones. Moreover, the

machine has some of the best growth potential available: seven drive bays, eight slots, and options for mass storage that exceed 1 gigabyte. At \$4,470, this machine represents one of your best buys, and with an FCC Class B rating, it is suitable for both office and home.

One other system deserves your attention, largely for the improvement it has made over its predecessor: Polywell Computers' Poly 386-33PT. Formerly a lackluster system, the Poly now shines in its attention to detail: wheels and a handle for easy movement, five drive bays accessible from the front of the system in addition to the two hidden inside, and extra-large RAM capacity on a motherboard of Polywell's own design. The company stands behind its system, too, offering a two-year warranty on the motherboard and graphics card and five years on labor. Only the machine's middling test results prevented it from receiving Editors' Choice status.

Bargain hunters may want to consider National Micro Systems' Flash 386-33 and the Tri-Star 386/33. The National Micro Systems PC offers decent performance, an FCC Class B certification, and the lowest price in the lot: \$3,199 for our standard configuration. The Tri-Star computer is notable for its attractive video and two-year warranty on parts and labor, and for its very attractive \$3,564 price in our standard configuration.

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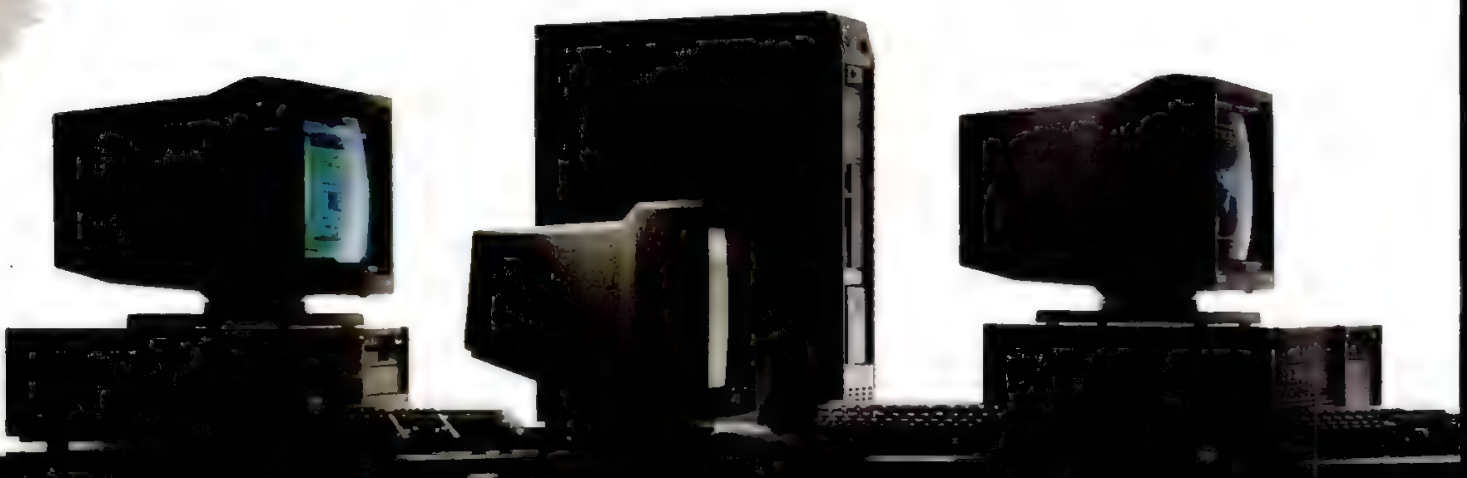
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	Legacy 386-25	Legacy 386-33	Legacy 486-33
IBM Power Platform MIPS	8.0	10.21	21.5
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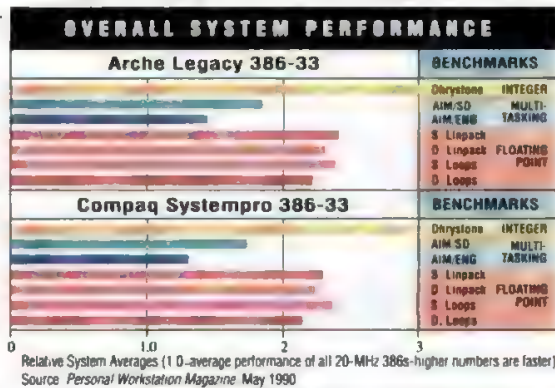
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INTERIOR CONFIGURATION KEY

CASE

Cases typically come in five sizes: full desktop (shown here), full-height small-footprint, half-height small-footprint, tower, and mini-tower.



MOTHERBOARD

Motherboards come in a wide variety of sizes, including full size (shown here) and small-footprint size.



EXPANSION BOARD SLOTS

In these diagrams, all slots are represented by full-size boards.



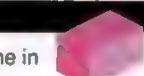
POWER SUPPLY

Power supply options fall into four categories: large (shown here), medium, small, and long and narrow.



DRIVE BAY

Drive bays typically come in four different sizes: full-height (shown here), half-height, one-third-height, and 3.5-inch size.



ment a computer, the motherboard architecture is the intrinsic real estate of a machine and replacing or modifying it is tantamount to creating a new computer, earning these 22 machines a return visit.

Not reviewed here or in the December 25, 1990, issue were Acer America Corp., Advanced Logic Research, AST Research, AT&T Computer Systems, BSM Computers, C² Microsystems, Compaq Computer Corp., CSS Laboratories, Dyna Computers, Eltech Research, FiveStar Computers, HIMS Technologies, Micro 1, Northgate Computer Systems, Oak MicroSystems, Olivetti USA, PC Link Corp., Ultra-Comp Computer Hardware, VPC Computers Corp., Wedge Technology, and Zenith Data Systems. While fine computers in their own right—the Acer 1100/33, Compaq Deskpro 386/33, and Northgate Elegance 386/33 were selected as Editors' Choices—the components of these computers have not significantly

changed since they were first reviewed. Another 386/33, from Touche Micro Technologies, arrived too late to be reviewed.

We also required each machine to use the ISA bus and to be equipped with 4MB RAM, a 64K RAM cache, a 150MB hard disk, a VGA or Super VGA display, DOS 3.3 or 4.01, and a standard hard disk controller in lieu of a caching controller.

REACHING THEIR PEAKS

Although the overall average price of these computers is still resting in the neighborhood of \$5,200, subtracting the five machines that tip the scales between \$8,000 and \$12,000 drops that average down to just above \$4,400. At that level, they have peaked in their lifespan in terms of price and performance. Faster 25-MHz and 33-MHz 80486 computers are already here and they have become the new powerhouses; still faster 80586 processors loom on the horizon. But there's no need to worry about the imminent demise of the 33-MHz 80386.

The 20-MHz 386SX and 25-MHz 386DX computers, both with and without processor RAM caches, offer possible alternatives, but the significant overlap in both the price and performance levels at this tier of computing does more to obscure their potential benefits than simplify the selection beyond budgetary considerations. There is also a significant overlap

Until the 80486 pricing drops from the stratosphere, the 386/33 remains the fastest 32-bit PC with the best price/performance ratio.

in pricing between machines in the 386 25-MHz and 33-MHz families, but here there is no similar overlap in performance. The 33-MHz machines are faster and, in many cases, just as inexpensive as their 25-MHz cousins. Until the 80486 pricing drops from the stratosphere, the 33-MHz 80386

represents the fastest 32-bit computer on the market at the most affordable price/performance ratio. And the increasing number of FCC Class B-rated machines in this genre are making them as viable in the home as they are in the office.

Certainly, at some point, the 33-MHz 80386 will disappear, but before that happens there will need to be a shakeout among the current crop of SXs and 25-MHz 386DXs. Even when 33-MHz machines reach the bottom of the pile and come to their next phase—fodder for home shopping networks—they will still be the most economical choice for the ever increasing number of applications designed around graphical user interfaces. Their design gives them a tenacious grip on the future of computing. Expect these machines to remain the ideal working environment for some time to come.

AMAX ENGINEERING CORP.

Amax 386/33 Business Station

by Bruce Brown

Amax Engineering has had a 33-MHz 386 machine on the market for more than a year. The current model, the Amax 386/33 Business Station, has a different case, motherboard, and video and drive controllers from the Amax system we reviewed last year. And it is significantly less expensive, too (see "High-rise Computing: 22 Powerhouse PCs Top Off at 33 MHz," *PC Magazine*, October 31, 1989).

Equipped to meet the standard configuration for this article, the Amax 386/33 bears a list price of \$3,875. That buys you a tower machine with 4MB of RAM, a 64K processor RAM cache, a 210MB 18-millisecond Rodime IDE hard disk, a 1.2MB TEAC floppy disk drive, a 16-bit Impression Super VGA adapter with 256K of video RAM, and a 14-inch interlaced Impression Super VGA monitor. Other standard components include a 101-key Maxi-Switch keyboard, one parallel and two serial ports, DOS 4.01, and *Microsoft Windows 3.0*.

Our evaluation unit was more fully equipped, and its list price reflects that fact. The test system had 8MB of RAM, a 347MB Maxtor hard disk, a 120MB CMS tape backup unit, one 1.2MB and one 1.44MB TEAC floppy disk drive, an Or-



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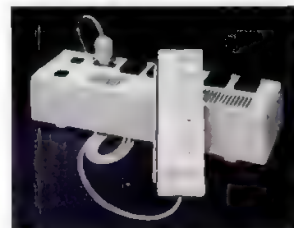
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33-MHz 386 PCs

chid ProDesigner II Super VGA adapter with 1MB of video RAM, and a 20-inch noninterlaced Seiko Super VGA monitor. The loaded test machine costs \$7,215—about the same as Amax's earlier standard-configuration model.

At the opposite end of the price and fea-



Amax 386/33 Business Station, \$7,215.

tures spectrum is the Amax 386/33 in its basic configuration, which includes only a 64K processor RAM cache, a 101-key keyboard, and one parallel and two serial ports and lists at \$1,670.

While the price of the Amax has come down a lot since we last reviewed the system, its performance hasn't changed much. On PC Magazine Labs' benchmark tests the Amax 386/33's memory score was average compared with the competition, while its processor scores were below average. Its small- and large-record DOS File Access test scores were the fastest among the PCs we tested. The machine's BIOS Disk Seek score was about average for the group but right for the Maxtor drive's 16-millisecond rating. The system's video scores were about average.

Amax manufactures its own motherboard and utilizes the AMI BIOS and the Chips and Technologies chip set. The system will run at either 8 or 33 MHz, with the I/O bus set at a constant 8 MHz. The AMI BIOS supports both video and system BIOS shadowing, each of which can be disabled via the CMOS setup program. Processor RAM cache logic circuitry is built into the motherboard. The 64K cache of 15-nanosecond static RAM is nonexpandable. The system has a socket for a 33-MHz Intel 80387 math coprocessor, and Amax sells a IIT math coprocessor as well.

Total memory for the system is limited to 16MB, with 8MB of DIPs and SIMMs on the motherboard and another 8MB of SIMMs installable with an optional 32-bit memory expansion card. All memory chips in the test system were rated at 70 ns.

The Amax 386/33's tower case measures 25.5 by 7.3 by 17.5 inches (HWD). If you extend the system's support feet (a good idea), the width at the very bottom of the unit increases to 9.3 inches.

The Amax 386/33 has eight expansion slots: one 8-bit, six 16-bit, and one that doubles as either a 32-bit memory expansion card slot or an 8-bit slot. With a video controller, a tape-backup adapter, an UltraStor integrated floppy/hard disk controller, and an I/O card installed, our evaluation was left with four free slots.

Inside the case is room for six half-height drives, four of which can use removable media. This amount of expansion space is a bit small for a tower model, but it is certainly adequate for most users. The Amax 386/33's power supply is a 300-watt unit from PC Power and Cooling and has four device leads. The power switch, turbo switch, reset switch, and keyboard lock are all located on the front of the case. There is no mechanical case lock.

Amax sells systems through dealers only. The standard parts-and-labor warranty is for one year, with all service provided through the dealer—as long as the

dealer remains in business. There is no standard on-site service contract, but an optional deal through Memorex Telex is available. The Amax 386/33 has FCC Class A certification; an FCC Class B-certified desktop model is also available, but it offers fewer expansion options.

The Amax 386/33 Business Station is a fairly priced 33-MHz machine with average overall performance. It may not be the most exciting model out there, but it's a fine machine and a good buy.

ARCHE TECHNOLOGIES INC.

Arche Legacy 386-33 Workstation

by Bruce Brown

If you're willing to pay a premium for an especially high-performance system, look closely at the Arche Legacy 386-33 Workstation. One of the best overall performers on PC Magazine Labs' benchmark tests this time around, the FCC Class B-certified Legacy 386-33 offers a lot of bang for a lot of bucks.

Geared to conform to our standard test configuration, the Legacy 386-33 costs \$8,240, including 4MB of RAM, a 128K processor RAM cache, a 158MB Maxtor ESDI hard disk, 1.2MB TEAC floppy disk drive, a Tseng Laboratories Super VGA video adapter equipped with 512K of video RAM, and a 14-inch Arche color VGA monitor. Other system components include a 101-key Hi-Tek keyboard, one parallel and two serial ports, and DOS 3.3.

Our evaluation unit had more on board. For \$10,263 you get the standard configuration plus 4MB more RAM (for a total of 8MB), a 120MB tape backup, an additional 1.44MB floppy disk drive, and a 33-MHz Intel 80387 math coprocessor. The basic configuration, with 4MB of RAM, 64K of processor RAM cache, one 1.2MB floppy disk drive, a 101-key keyboard, one parallel and two serial ports, and DOS 3.3 costs \$5,255.

The Legacy 386-33's 6.5- by 21.3- by 16.5-inch housing can accommodate five half-height drives, which many would consider a minimal amount for a high-speed 386 system in a full-size case. For \$200 more you can buy a tower case, which has room for two half-height, two 3.5-inch, and two full-height drives (each full-height bay can accommodate two half-height units). The power supply on the test

FACT FILE

Amax 386/33 Business Station
Amax Engineering Corp., 47315 Mission Falls Ct., Fremont, CA 94539; (800) 888-5268, (800) 888-2629 (in Calif.), (415) 651-8886.
List Price: With 4MB RAM, 210MB hard disk, 1.2MB floppy disk drive, 256K Super VGA color display subsystem, DOS 4.01, Microsoft Windows 3.0, \$3,875; with 8MB RAM, 347MB hard disk and 120MB tape backup, 1.2MB and 1.44MB floppy disk drives, Orchid ProDesigner II 1MB Super VGA video adapter, Seiko 20-inch Super VGA noninterlaced color monitor, \$7,215.
In Short: Amax's lower-style 386/33 Business Station offers average performance, average expansion room, dealer-based service and support, and a competitive price.

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COMPUTERS

33-MHz 386 PCs

machine was a 200-watt Arche unit with four device power leads. (Arche is now shipping 275-watt units.)

Arche makes its own motherboard and incorporates some sophisticated technology that helps its machine perform well on our tests. The system clock will run at ei-



Arche Legacy 386-33 Workstation, \$10,263.

ther 8 or 33 MHz, and the I/O bus can run at either 8 or 11 MHz. The BIOS is a special Arche version of the AMI BIOS.

One of the most interesting aspects of the Legacy 386-33's motherboard is Arche's ProCache processor RAM controller. This setup, in addition to running a standard 128K cache of 20-nanosecond static RAM, takes care of all memory management, off-loading that task from the CPU. In addition, the ProCache handles many DMA calls, so the CPU doesn't have to stop what it's doing to respond to signals from the DMA chip set.

By taking over DMA the ProCache processor RAM controller performs what Arche calls "snooping," that is, examining the cache to prevent conflicts. This intelligent cache technology pays off in performance and also addresses a concern of those who wonder about the benefit of caching lots of vital information during normal processing.

The Arche motherboard can shadow either system or video BIOS. You can enable or disable either one through the CMOS setup program, which is also the place from which you set the bus speed. The motherboard can also take either an Intel 80387 33-MHz math coprocessor or a Weitek 3167.

The Legacy 386-33 was a top performer on our processor and conventional memory tests. Its hard disk performance was on the fast side of average, as were its video scores.

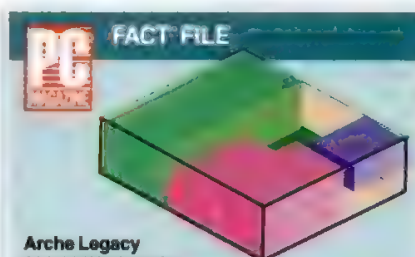
You can fit up to 16MB of RAM on the

motherboard using 2MB SIMMs. In addition, two 32-bit memory expansion slots can each take a memory expansion card capable of holding 12MB RAM; prices for the cards had not been set at this writing. With two loaded memory cards and a motherboard populated with 8MB of 1MB SIMMs, the system can hold up to 32MB of RAM. If you fill the motherboard with 2MB SIMMs, then you'll have to leave one of the expansion cards two-thirds empty because 32MB is the current system limit.

If you don't use the two 32-bit slots for memory, you can put 16-bit expansion cards in them, which, added to the other six 16-bit slots, gives you eight 16-bit slots. In a standard setup, six slots are free, since the I/O ports are integrated into the motherboard.

The Arche case is well made. A power switch is located on the right side, and a reset switch and a keyboard lock are on the front. The unit does not have a turbo switch or a case lock.

Arche sells systems through dealers and VARs. The system is backed by a two-year warranty, and Arche's service policy is fairly flexible. Under the standard warranty you can get service for your system either at a dealer, at Arche's California facility, or at any TRW service depot. An optional on-site service contract with TRW costs \$149 for the two-year warranty period, but you must elect this kind of ser-



Arche Legacy

386-33 Workstation

Arche Technologies Inc., 4881 Kato Rd., Fremont, CA 94539; (800) 422-4674, (415) 623-8100.

List Price: With 4MB RAM, 1.2MB floppy disk drive, one parallel and two serial ports, DOS 3.3, \$5,255; with 158MB hard disk, Super VGA color display subsystem, \$8,240; with 8MB RAM, 120MB tape backup, 1.2MB and 1.44MB floppy disk drives, math coprocessor, \$10,263.

In Short: Fast and expensive, the Arche Legacy 386-33 Workstation is backed by a two-year warranty. Its ProCache processor RAM controller runs a standard 128K cache, takes care of all memory management, and handles many DMA calls. The machine offers a reasonable amount of room for adding memory.

CIRCLE 619 ON READER SERVICE CARD

vice during the first 30 days that you own your system.

Cache coherency and high-performance motherboard design will become increasingly important as computers continue to get faster. The Arche Legacy 386-33 is a particularly fast machine in a fast cohort. If you have the money to spend and need breakneck speed, this one deserves close study.

AUSTIN COMPUTER SYSTEMS INC.

Austin 386/33 Winstation

by Bruce Brown

Read on if you're looking for a solid 33-MHz machine in a small desktop case from a company with top service and support policies. Austin Computer Systems' Austin 386/33 Winstation won't race ahead of the rest of the 33-MHz competition, but it does pack a good number of expansion options in an attractive compact package. It also sells at a pretty attractive price.

Our evaluation unit—a common Austin configuration—costs \$4,390. For that price you get 4MB of RAM, a 128K processor RAM cache, a 175MB 16-millisecond Imprimis IDE hard disk, a 1.2MB or 1.44MB Chinon floppy disk drive, Austin's Super VGA video board (which is based on the Tseng Laboratories chip set and comes with 1MB of video RAM), and a Mitsubishi Diamond Scan 14-inch Super VGA monitor. Also standard are one parallel and two serial ports, a Chicony 101-key keyboard, DOS 4.01, *Microsoft Windows 3.0*, and a serial Microsoft Mouse. The machine comes with DOS and *Windows* installed and configured for the monitor in 800-by-600 mode.

A difference of \$500 separates the standard-configuration Winstation 33 from the basic configuration. For \$3,890, you get the same amount of memory and cache, choice of floppy disk drives, number of ports, keyboard, and operating system software, with a 110MB IDE hard disk, a VGA adapter, and Mitsubishi VGA monitor.

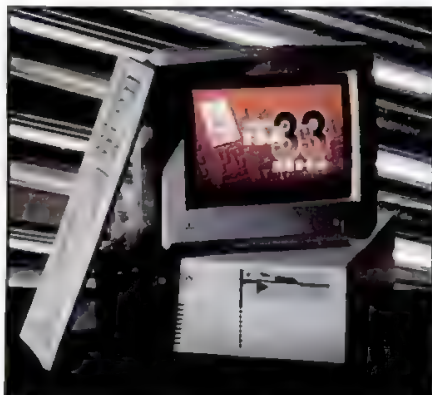
The Winstation measures just 6.5 by 16 by 16.5 inches. Even though it's fairly small, the case can accommodate five drives—three 5.25-inch half-height drives and two 3.5-inch devices. The 200-watt Seasonic power supply has five power

COMPUTERS

33-MHz 386 PCs

leads, so you won't need to use a power splitter if you fill the drive bays. The power switch is on the back of the case, and the reset switch and keyboard lock are on the front.

The Austin-manufactured motherboard is built around the OPTI 386 chip set,



Austin 386/33 Winstation, \$4,390.

which includes cache circuitry and Quadtel's 386 BIOS. The cache is fixed at 128K and uses 25-nanosecond static RAM chips. The motherboard supports video and system BIOS shadowing, both of

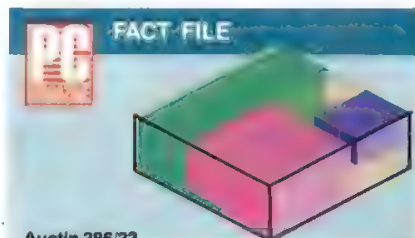
which are set via the CMOS setup program, and has a socket for an Intel 80387 33-MHz math coprocessor. The system can be slowed down from 33 MHz to 8.25 MHz, and the bus speed is fixed at 8 MHz.

The Austin motherboard has eight SIMM slots. With built-in support for 256K, 1MB, and 4MB SIMMs, the motherboard can accommodate up to 32MB of RAM. The system has seven expansion slots—one 8-bit and six 16-bit. Since the IDE drive interface and I/O circuitry are integrated into the system, six slots remained free after a video card was installed in our evaluation unit.

The Winstation's performance on PC Magazine Labs' benchmark tests was mixed. Its processor scores were on the slow side of average, but its conventional memory score was a bit faster than average. Its performance on the small-record DOS File Access test was fairly fast, but its scores on both the large-record DOS File Access test and the BIOS Disk Seek test were slow. The machine's video scores were all better than average, reflecting the performance edge of the excellent Tseng

Laboratories video chip set.

Austin sells computers through mail order only. Like all Austin computers, this



Austin 386/33

Winstation

Austin Computer Systems Inc., 10300 Metric Blvd., Austin, TX 78758; (800) 752-1577, (512) 339-3500.

List Price: With 4MB RAM, 110MB hard disk, 1.2MB or 1.44MB floppy disk drive, 256K VGA color display subsystem, one parallel and two serial ports, DOS 4.01, Microsoft Windows 3.0, Microsoft Mouse, \$3,890; with 175MB hard disk, Super VGA color display subsystem, \$4,390. **In Short:** This small-footprint 33-MHz machine packs a good number of expansion options into an attractive, compact case. It offers fast video performance and is backed by superb customer service and support policies. The package is easy to recommend.

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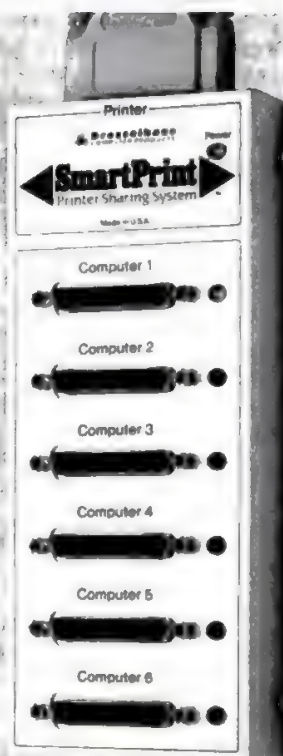
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offers a toll-free technical support line, toll-free customer service, and a 30-day money-back guarantee.

The Austin 386/33 Winstation isn't the fastest machine, and it isn't the least expensive. But its expansion options and small case, coupled with Austin's excellent service and support policies, make it a machine to consider very seriously.

BLACKSHIP COMPUTER SYSTEMS INC.

Blackship 386/33

by Edward Mendelson

From the outside, Blackship Computer Systems' Blackship 386/33 looks like any other mail-order AT clone, and the inside doesn't contain any surprises. That's an advantage. This machine, which has Class B FCC certification, is a solid, sturdy design and sells at a reasonable price—\$3,880—equipped to meet *PC Magazine's* standard configuration, including 4MB RAM, an Intel 82385 cache controller and a 64K processor RAM



Blackship 386/33, \$3,795.

cache comprising 25-nanosecond DIPs, a 158MB Maxtor ESDI hard disk, a 1.2MB TEAC floppy disk drive, a Key Tronic 101-key keyboard, and an Orchid ProDesigner II Super VGA card and CTX 3436 multiscanning monitor. If you want to start small, you can get a 1MB monochrome system with no hard disk and only 32K of processor RAM cache for \$1,895. If you also want DOS 4.01 or 3.3 you will be set back an additional \$85.

Blackship offers plenty of options inside and out. The system can support an Intel 80387 and a Weitek 3167 math coprocessor simultaneously. The Micronics

motherboard lets you change the bus speed from the standard 8 MHz to 11 MHz or even 16.5 MHz via DIP switches. Most newer peripherals will probably run without problems at 11 MHz, but 16.5 MHz is a choice recommended only for those who don't mind living dangerously until they're certain their peripherals will work.

The system itself can be switched downward from its standard 33 MHz to 6 or 8 MHz. You slow the system down via software, but you can also bring it back to full speed by pressing the turbo switch on the front panel. If you're at full speed, the turbo switch doesn't do anything.

The Micronics motherboard uses a Phoenix BIOS, which supports video and system BIOS shadowing; both can be disabled through DIP switches. The motherboard is built around discrete logic and is home for eight 16-bit slots, one of which doubles as a 32-bit slot for a proprietary 32-bit memory board. This layout has two potential disadvantages. If you want to add RAM beyond the standard 4MB installable with 80-ns. 1MB SIMMs on the motherboard, you have to buy the memory card for \$150, which also takes 1MB SIMMs. When you use the memory card, you give up a slot. More-up-to-date motherboard designs have room for 16MB of 1MB SIMMs or even 64MB of 4MB SIMMs on the motherboard itself, and use no slots for extra memory.

The lack of an 8-bit slot is less of a disadvantage, although it's remotely possible that you'll someday want to plug in an old-style 8-bit card that has a skirt that makes it fit only in 8-bit slots.

When Blackship installed the game port, parallel port, and two serial ports in the machine it sent to PC Magazine Labs, it sensibly mounted the two serial ports in the extra port openings at the back of the case, rather than wasting a slot as other vendors do. As a result, most systems will have five free slots, which may compensate for the potential loss of a slot when you install the memory card.

For the most part, the Blackship 386/33 performed among the top half of the machines we tested, with the Orchid ProDesigner VGA board bringing in notably fine results. The Orchid card comes with 1MB of RAM and can produce noninterlaced video with a top pixel resolution of 1,024 by 768.

Blackship's 158MB 14-millisecond Maxtor hard disk is a full-height design.

You may be better off trying to find a half-height model, if you want to preserve all possible expansion options. The machine's Western Digital integrated hard-and-floppy disk controller comes with a 32K buffer. With the full-height hard disk and half-height floppy disk drives installed, our evaluation unit still had two empty half-height drive bays.

The most unsettling feature of the

Blackship 386/33
Blackship Computer Systems Inc., 4031 Clipper Ct., Fremont, CA 94538; (800) 877-6249, (415) 770-9300.
List Price: With 1MB RAM, 32K processor RAM cache, 1.2MB floppy disk drive, one parallel and two serial ports, monochrome display subsystem, \$1,895; with 4MB RAM, 64K processor RAM cache, 158MB hard disk, Orchid ProDesigner II VGA card, CTX multiscanning Super VGA monitor, \$3,795; with DOS 3.3 or 4.01, \$3,880.
In Short: The Blackship 386/33 offers a good choice of standard components. Unlike more-up-to-date designs, this one uses a Micronics motherboard that requires a slot-wasting card for any 32-bit RAM beyond 4MB.

CIRCLE 821 ON READER SERVICE CARD

Blackship 386/33 is its 6.5- by 21- by 16-inch AT-style case, which will be troublesome if you ever need to open it to install an expansion card or hard disk. The case can be exceptionally difficult to pull open and almost impossible to close again. A Blackship technician agreed that the case was difficult to work with at first, but added that once you learn the trick of getting everything lined up, you should find it easy to put the case back together again. However, you may never learn the trick.

BOSS TECHNOLOGY CORP.

Boss 3633-S

by Edward Mendelson

With overall performance within the top third of the machines we tested and with 486 upgradability as an option, Boss Technology's 3633-S is designed for speed demons who are never satisfied. To be sure, \$8,395 looks like a high price for our standard configuration (including 4MB of

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Endurance Tests Data
186/25A—Jan 16, 1990

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Data 386/25
May 30, 1989

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Data 386/25
Nov 3, 1989

PC
MAGAZINE

**EDITORS'
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Data 386/16
Feb 28, 1989

PC
MAGAZINE

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Portacomp II
Oct 11, 1988

RAM, a 64K processor RAM cache comprising 15-nanosecond DIPs, a Seagate 160MB ESDI hard disk, a 1.2MB and a 1.44MB TEAC floppy disk drive, one parallel and two serial ports, a game port, and DOS 4.01, plus a Cardinal Super VGA card and CTX multiscanning monitor). But the Boss 3633-S is normally discount-



Boss 3633-S, \$8,395.

ed by the dealers who comprise its distribution channel.

If you're not satisfied with the performance of this 33-MHz 80386 tower system, you can wait a few months until 33-MHz 486 chips are widely available, and then plug an optional 486 adapter card into a proprietary slot on the motherboard. The 486 chip will take over from the 386, and you'll convert your system into a full-fledged 486 machine.

Boss's motherboard and BIOS are made by AMI, which builds this 486 upgrade capability into its latest 386-model boards; the machine's chip set is manufactured by Chips and Technologies. The AMI motherboard gives you two 8-bit and six 16-bit slots as well as 16 SIMM sockets—enough for up to 16MB in 70-nanosecond 1MB SIMMs and upgradable to a maximum of 64MB in 4MB SIMMs. You don't have to waste a slot on a proprietary memory board to increase system RAM. The BIOS provides for system and video BIOS shadowing, and the system can support both an Intel 80387 and a Weitek 3167 math coprocessor simultaneously.

If you're willing to forgo 486 upgradability, a hard disk, and a second floppy disk drive, and you can live with VGA resolution and a monochrome VGA monitor, you can buy the Boss in its \$5,294 minimum configuration (which also includes

4MB of RAM and 64K of processor RAM cache). This stripped-down model uses a less-advanced version of the AMI motherboard, which is why you cannot upgrade the machine to the level of a 486.

Both the minimally and more-richly endowed models come only in a tower case. The Boss 3633-S's 25.5- by 7.5- by 17.8-inch case has six drive bays; all are accessible from the front. Four hold half-height devices; two hold 3.5-inch devices.

In addition to the AMI motherboard, Boss packs its machine with some other excellent components. The hard disk is a top-of-the-line 14-millisecond Seagate ESDI; SCSI and IDE models in several storage capacities are also available. The controller is a solidly designed floppy/hard disk Western Digital WD-1007SE2 model with a 32K buffer. The power supply is a quiet, reliable 300-watt unit from PC Power and Cooling. The 101-key keyboard is by Honeywell. The 16-bit Cardinal Super VGA card, which uses the Chips and Technologies chip set, produced admirably fast scores on PC Magazine Labs' benchmark tests. With quality components like these, Boss can offer a two-year warranty, with cross-shipping of parts when needed. On-site service from the Computer Service Network is available at \$295 per year.

FACT FILE



Boss 3633-S
Boss Technology Corp., 6050 McDonough Dr., Norcross, GA 30093; (800) 628-1787, (404) 368-2077.

List Price: With 4MB RAM, 64K processor RAM cache, 1.2MB floppy disk drive, one parallel and two serial ports, game port, monochrome VGA display subsystem, \$5,294; with 4MB RAM, 64K processor RAM cache, 160MB hard disk, one 1.2MB and one 1.44MB floppy disk drive, Cardinal VGA card, CTX multiscanning Super VGA monitor, DOS 4.01, \$8,395.

In Short: This tower machine offers exceptionally high-quality components at a substantial list price. On the more expensive configurations, the user can upgrade the motherboard to a 33-MHz 486 (when the chips become available) by plugging a card into a proprietary slot. The computer is backed by a two-year warranty.

CIRCLE 622 ON READER SERVICE CARD

The tower case itself is solid, but like most tower cases, it's a bit awkward to get into because you have to lift off an unwieldy piece of metal that's been folded to become both the sides and the top. Once you've taken its cover off, the machine's layout is roomy and easy to manage, and Boss sensibly mounts the serial ports in the extra openings at the back of the case to avoid wasting a slot. The case has a power switch, a reset button, and a keyboard lock on the upper front panel. A turbo switch on the same panel does nothing at all; you use the keyboard to switch the system speed from 33 MHz to 8 MHz and back again.

Boss's 33-MHz tower model is among the most solid and advanced 386 systems we tested, and within a few months you'll be able to turn it into an equally solid 486 system. With its six drive bays for expansion, this FCC Class A-certified system is one you can live and grow with.

BUS COMPUTER SYSTEMS INC.

Bus 386-33

by Edward Mendelson

If you're looking for a bargain-priced 33-MHz 386 machine, Bus Computer Systems' Bus 386-33 may be the answer. This inexpensive mail-order machine, made with a mix of lesser- and well-known components, costs a mere \$3,725 in *PC Magazine's* standard configuration. For that small sum, you get 4MB of RAM, a 64K processor RAM cache comprising 25-nanosecond DIPs, a 157MB NEC ESDI hard disk, one 1.2MB TEAC and one 1.44MB Sony floppy disk drive, an anonymous Super VGA card and a 14-inch NEC MultiSync 3D monitor, one parallel and two serial ports, a game port[[OK TK]], a Chicony 101-key keyboard, and DOS 4.01. Dispense with the hard disk, the 1.44MB floppy disk drive, and DOS, settle for 1MB RAM, and accept an MDA adapter and monitor, and you pay a mere \$1,699.

In appearance, the 6- by 21- by 16-inch Bus 386-33 looks like any AT clone that comes in a sturdy case; it holds few surprises inside or out. Bus Computer Systems builds its 33-MHz computer around an Armas motherboard, which uses discrete logic and is made in Taiwan, and the familiar AMI BIOS. The BIOS supports both system and video BIOS shadowing. The motherboard can accommodate an In-

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- 1) **Speed:** "Dataworld's disk-intensive total was the best"
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- 3) **Battery:** "No other system in this comparison (Compaq nor Toshiba) supports a battery."
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LP320 Laptop Optional Features

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COMPUTERS

33-MHz 386 PCs

tel 80387 and a Weitek 3167 math co-processor simultaneously.

The motherboard comes with 4MB of RAM installed in the form of 1MB DIPs rated at 70 nanoseconds. You can add up to 12 1MB SIMMs to the 4MB of DIPs for



Bus 386-33, \$3,725.

a total of 16MB of system memory, or you can pull out the DIPs and install up to 64MB of 4MB SIMMs. You'll have to reset some jumpers to tell the board which form of RAM you're using, but a huge diagram supplied with the computer makes

the job simple.

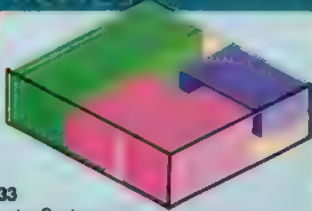
A turbo switch on the front panel switches the system speed to 25 MHz, although it's unlikely you'll find software that runs at 25 but not at 33 MHz. The system comes with separate manuals for the motherboard and expansion cards, but you probably don't need an integrated manual if you're in the market for this class of computer.

Inside our evaluation unit was an Ultra-Stor floppy/hard disk controller with a 32K buffer—one of the fastest controllers on the market, with excellent setup and testing software built into ROM. The 157MB ESDI hard disk was a quiet 18-millisecond NEC half-height model, and the combination of disk and ESDI controller attains a quality level far higher than the system's low price might suggest. With three half-height devices installed, our evaluation unit had two empty half-height drive bays, offering ample room for expansion. Bus sells other ESDI disks ranging from 110MB to 670MB, and IDE disks ranging from 40MB to 200MB.

The only unknown quantity in the ma-



FACT FILE



Bus 386-33
 Bus Computer Systems
 Inc., 135 West 26th St., New York, NY 10001;
 (800) 451-5279, (212) 627-4485.
List Price: With 1MB RAM, 64K processor RAM cache, 1.2MB floppy disk drive, one parallel and two serial ports, game port, monochrome display subsystem, \$1,699; with 4MB RAM, 157MB hard disk, one 1.2MB and one 1.44MB floppy disk drive, Super VGA card, NEC MultiSync 3D Super VGA monitor, DOS 4.01, \$3,725.
In Short: The Bus 386-33 is a low-priced mail-order machine using good-quality components and a relatively slow VGA card. Its parts come from a mixture of well-known and little-known suppliers. It's a good choice for bargain hunters.

CIRCLE 623 ON READER SERVICE CARD

chine, an OEM Super VGA card based on the Trident chip set, promises a lot, with its 1MB of video RAM and a top pixel resolution of 1,024 by 768. Its performance on PC Magazine Labs' benchmark tests was disappointing, however, earning the machine the distinction of being the second

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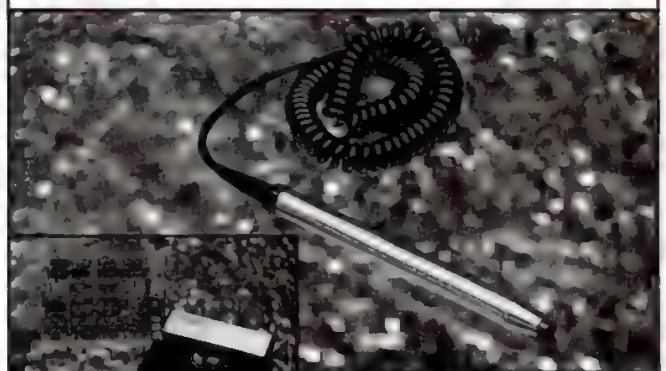
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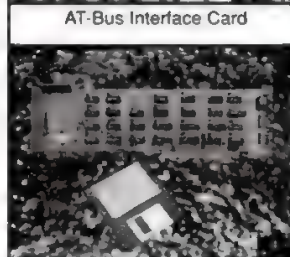
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slowest on our video tests this time around. Overall, the Bus 386-33's performance in our tests was on the slow side of average but still acceptable.

Of the Bus 386-33's one 8-bit and seven 16-bit slots, four are occupied with basic equipment. The I/O card has its parallel and game ports on its mounting bracket and its two serial ports attached to cables. Bus Computer Systems mounts the two serial ports on a dummy mounting bracket installed where you could otherwise seat another expansion card. This slot-wasting scheme can easily be fixed by moving the serial ports to two of the five extra port openings on the back of the case, but Bus should save you the trouble by mounting them there in the first place.

One of the most attractive parts of the Bus package is something you won't find in the rather flimsy box: a year of on-site service by GE. All in all, this FCC Class A-certified machine is one to consider if you're on a budget but want a feeling of luxury and security.

CLUB AMERICAN TECHNOLOGIES INC.

Club Hawk I

by Bruce Brown

A great tower case, a terrific price, and average performance are the salient features of Club American Technologies' Club



Club Hawk I, \$3,755.

Hawk I. Inside the beautiful housing of this FCC Class B-certified 33-MHz machine, you'll find space for up to nine half-height 5.25-inch drives, drive shock

mounting, and a 250-watt power supply with seven power leads and two fans, proving that aesthetics need not be compromised when form follows function.

Loaded to meet our test requirements, this formidable tower unit costs a mere \$3,755, including 4MB of RAM, a 64K processor RAM cache, a 14-millisecond 158MB Maxtor ESDI hard disk with an UltraStor integrated controller, a 1.2MB TEAC floppy disk drive, a Club AT Super VGA video card based on the Tseng Laboratories chip set, and a Club AT Super VGA interlaced monitor. Also part of the package are one parallel and two serial ports, a 101-key Key Tronic keyboard, DOS 4.01, *Microsoft Windows* 3.0, and a serial *Microsoft Mouse*.

In its least expensive configuration, the Club Hawk I costs \$2,685 and offers 2MB of RAM, 64K processor RAM cache, a 1.2MB floppy disk drive, one parallel and one serial port, a 101-key keyboard, your choice of DOS 4.01 or 3.3, *Windows* 3.0, and the *Microsoft Mouse*.

Club AT's own motherboard can run at either 11 or 33 MHz, and the I/O bus can run at either 5.5 or 8.25 MHz. The 386 support circuitry is integrated into the motherboard, as is the controlling logic for the processor RAM cache. The 64K of 20-nanosecond static RAM in our test unit is expandable to 256K. The cache is dual-read, write-back with a 64-bit cache bus.

The Hawk I uses an AMI BIOS. The BIOS does not provide for video BIOS shadowing, but you can enable or disable system BIOS shadowing via setup. The system can accommodate either a Weitek 3167 or an Intel 80387 33-MHz math coprocessor.

Club AT's entry offers nothing unusual in the way of memory setup. The Hawk I's motherboard can handle a maximum of 8MB using fast page 1MB SIMMs. You can boost system memory by another 8MB with an optional \$135 memory expansion card that fits in a single 32-bit slot. In our evaluation unit, the SIMMs were rated at 80 ns.

ROOM TO GROW

For expansion the Hawk I offers eight slots: one 8-bit, six 16-bit, and one proprietary 32-bit slot that can be used to hold an 8-bit card. After video, drive, and I/O cards were installed in our evaluation unit, we were left with five free slots, which should suffice in most cases.

Even better news for expansion-minded users is the Hawk I's roomy case. A sight to behold, the 25.5- by 8.8- by 20.5-inch housing allows you to stack five half-height drives one on top of the other in the top front of the unit. Below that is room for either two full-height or four more half-height devices. All switches—power, reset, and turbo—and the keyboard lock are on the front of the case; a case lock is on the back. A door protects the drive front and the system switches.

The Hawk I's performance on PC Magazine Labs' benchmark tests was respectable, if mixed. On our 80386 Instruction Mix processor tests, its score was equal to the fastest machines. But on our Conventional Memory test its performance was slower than average. On our BIOS Disk



FACT FILE

Club Hawk I

Club American Technologies Inc.,
3401 W. Warren Ave., Fremont, CA
94539; (415) 683-6600.

List Price: With 2MB RAM, 1.2MB floppy disk drive, one parallel port and one serial port, DOS 4.01, *Microsoft Windows* 3.0, *Microsoft Mouse*, \$2,685; with 4MB RAM, 158MB hard disk, Super VGA color display subsystem, \$3,755.

In Short: Nine half-height drives will fit into Club AT's Hawk I, a beautiful tower-style machine. The performance is average; the price is very attractive; service and support policies are fairly good, with on-site service a \$99 option you probably shouldn't pass up. This one is sold through VARs and direct from the manufacturer to corporate accounts.

CIRCLE 624 ON READER SERVICE CARD



Seek test, the 14-ms. Maxtor hard disk proved true to its rating.

Club American Technologies sells its machines directly to corporate customers and through VARs. A one-year parts-and-labor warranty is standard. For service, you'll have to ship your machine back to Club AT, unless you sign up for Club Priority on-site service. This gets you 8-hour service for \$99 for the first year. The company also offers a 30-day money-back guarantee.

If you need a machine with lots of room and a solid, secure case and you can settle for average rather than league-leading performance, the Club Hawk I probably has everything you need.

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In today's high performance PC's, disk access is the number one system bottleneck. The SERIES 400 from SSDC is a new class of hard drive controller with its own powerful on-board parallel processor and memory to independently manage disk drive data. The SERIES 400 actually anticipates what information the PC is going to need and stores the data in its own high-speed cache RAM. Disk accesses are 100 times faster and large file transfers are up to 10 times faster. This means applications load and execute fast! Even the slowest and most cumbersome applications become lightning quick. All applications - Windows, CAD, large databases, desktop publishing - become supercharged with near instant file access. SSDC has broken the price barrier to hardware disk caching. No longer is powerful disk performance limited to mainframe systems.

SERIES 400 Benefits

- Tremendous increases in system performance
- Accelerates disk access over 100 times
- Increases file transfer rate 5 to 10 times
- Speeds up ALL disk-intensive applications
- Frees up system resources for increased performance

Across the Board Performance Advantage

	SERIES 400	DPT-3011	FTI 2410
Effective seek time	0.270 msec	0.520 msec	0.500 msec
Read data transfers	2230 Kb/sec	892 Kb/sec	1150 Kb/sec
Large record read	16.0 sec	25.0 sec	36.0 sec

Feature Comparison

Retail Price	\$745.00	\$1195.00	\$1595.00
With 4-Mb RAM	\$995.00	\$2095.00	\$2190.00
Max memory on-board	4Mb	4Mb	2 Mb
Memory type	Std. SIMMS	Custom	Custom
WD-1003 Emulation	Yes	Yes	Yes
Custom drivers	Optional	No	Optional
Drive types supported	IDE, SCSI, RLL ESDI, MFM	ESDI, MFM, RLL	ESDI
Networks, UNIX and multiuser systems	All	Most	Most
Boot drive	Any	"C" only	"C" only
1-to-1 interleave	Yes	No	No
Auto bad track repair	Yes	No	No
Parity check RAM	Yes	NO	Yes
I/O bus speed	12.5	10.0	10.0 (12.5 opt)
Data look ahead	Track	Sector	Sector

CACHE IN

Call Today

Cash in on the time you'll save with the SERIES 400 High-Speed Caching Disk Controller from SSDC. You'll enjoy startling increases in system performance, at an affordable price. Installation is simple and the SERIES 400 is fully compatible with all 486, 386 and 286 systems. Call toll free 1-800-284-7732 for your nearest SERIES 400 dealer.

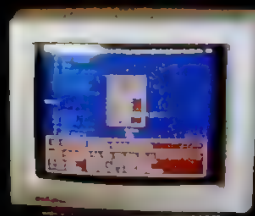
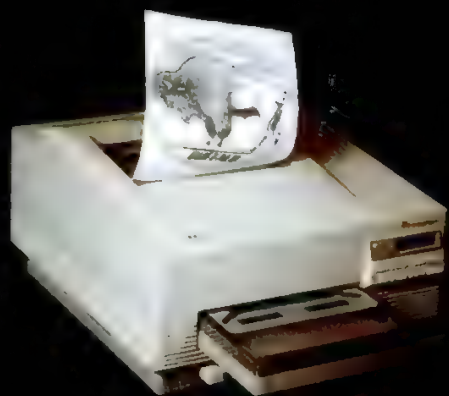
* 2nd quarter 1991

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HWP

5 Ports from \$325

All ports are parallel and user configurable as either 3 inputs to 2 outputs with a pop-up menu, or 4 inputs to 1 output as a buffered auto-switch; memory is user upgradable from 256KB to 16MB buffer

AS-41

5 Ports \$200

4 parallel inputs to 1 parallel output, automatic switch with no buffer; use the AS-31 for up to 3 inputs to 1 output, \$175

CE

2 Ports from \$175

Printer buffer with 1 parallel input to 1 parallel output, from 256KB to 4MB buffer

SPPS

Converter \$100

Combination serial-to-parallel, or parallel-to-serial interface converter in a single unit, no power supply needed, serial transfers to 115,200 bps, DIP switch configurable

RCJ

Toshiba Memory Module

Memory expansion module for the Toshiba T1000SE, T1000XE, or J3100SS laptop (notebook) computer, 1MB - \$199, 2MB - \$299

Cables & Adapters

High quality, 24 gauge shielded cables, parallel or serial; modular cable adapters

33-MHz 386-BASED PCs: SUMMARY OF FEATURES



Price of standard configuration For this review of 33-MHz 386 computers, we requested a standard configuration including 4MB RAM, a 64K RAM cache, a 150MB hard disk, one high-density floppy disk drive, a color VGA video display subsystem, at least one parallel and two serial ports, a keyboard, and DOS. In some instances, manufacturers do not offer the exact configuration *PC Magazine* requested, but all 26 of the PCs reviewed here provide a reasonably close match for this list of requirements.

All table entries except **price of standard configuration** describe the features of the systems *PC Magazine* actually tested. See each fact file for the price of the tested configuration.

Distribution channel Some machines are sold directly through mail order. When machines are sold by dealers, the purchaser may find discounts of 25 percent or more off the list price (although there is no guarantee that the discounts will run this high).

386 chip set manufacturer indicates which company makes the support logic that connects the CPU with the other functions managed by the system board. In some cases the computer uses discrete logic rather than a chip set.

The **system RAM arrangement** is the method in which memory is addressed. The design of system RAM aims at avoiding the wait states imposed when CPU speed outpaces conventional memory speed.

Interleaved memory increases processing speed by dividing the memory into two or four portions that process information alternately. The CPU sends information to one section for processing while another section goes through a refresh cycle.

Page-mode memory allows back-to-back memory accesses within blocks of memory called pages, avoiding wait states.

Row/column is the traditional method of accessing data at a memory address. RAM is mapped as a matrix, and a particular address is given using a row and a column number.

Maximum installable 32-bit RAM Separate rows indicate the maximum 32-bit memory possible on the motherboard and on a dedicated memory board.

RAM packaging (and rated speed) Memory chips come in a variety of styles: DIPs, SIPs, and SIMMs.

The **dual in-line package (DIP)** is the traditional computer chip sprouting 8, 14, 24, 40,

or more metal legs (evenly divided between right and left sides).

Single in-line packages (SIPs) are single-package arrays of computer chip logic assembled so that all connecting legs are in a straight line, like the teeth on a comb. They can be individual chips or multiple chips on a small card, with a proprietary SIP connection.

Single in-line memory modules (SIMMs) consist of individual logic devices installed on their own small circuit board, creating a component module that can be plugged into a larger device. Their physical arrangement facilitates installation and replacement.

Installed chip size Kb and Mb refer to kilobits and megabits, respectively. Combination chips (4x256Kb) are generally faster and more expensive.

The **BIOS version and date** can affect PC Labs' benchmark test results. Those purchasing the same machine with a different BIOS version may encounter some variations in performance.

Setup can reside on a floppy disk or in ROM.

Shadowing Shadow RAM is a technology that loads video BIOS or system BIOS directly into fast RAM on boot-up of the computer, offering enhanced performance speed. It uses a segment of system memory located between the boundary of conventional memory (640K) and the end of the first megabyte of installed RAM. The ability to disable shadowing is important with some applications to resolve memory conflicts.

Hard disk interface Within the 386 PC environment, the most common hard disk interfaces are **IDE (integrated drive electronics)**, **SCSI (small computer system interface)**, and **ESDI (enhanced small device interface)**. With an IDE interface, the drive contains its own controller electronics; by contrast, each non-IDE hard disk in this roundup has its controller on a card. IDE can offer good performance at a lower price than ESDI or SCSI.

Fading from popularity is the **RLL (run length limited)** interface, a data encoding technique that is more efficient in packing bits than the older **MFM (modified frequency modulation)** method.

Hard disk options The number of different hard disks the vendor offers for a machine is often indicative of how much customizing is available.

Bus speeds Bus speed becomes more important as computers run at faster clock speeds. A computer's bus speed may actually be too fast for expansion cards, most of which operate at 8 MHz.

The **display circuitry** can be either on an expansion card or on the motherboard. Motherboard circuitry is often faster, but if it cannot be disabled it prevents upgrades.

Video interface 16-bit video interfaces are typically faster than 8-bit because of their wider bandwidth. All of the computers in this roundup have 16-bit video interfaces.

DOS The availability and price of DOS 3.3 and 4.01 are listed here. If no price is shown, the base-priced system includes DOS. (*PC Magazine's* standard configuration includes DOS 4.01—or, if it is not available, DOS 3.3—to allow more-accurate price comparisons.)

Where **OS/2** is available, the version number and list price are provided.

Disk caching software Some companies provide software to facilitate data retrieval from the hard disk. This software speeds overall system performance by anticipating what data the processor will need next.

An **expanded memory manager** is software that emulates the Lotus/Intel/Microsoft (LIM) expanded memory manager within the extended memory of a 386 PC.

Other software is listed if it is bundled free of charge or at a nominal cost.

Weitek 3167 support Popular math coprocessors include the Intel 80387 and the Weitek 3167. All of the reviewed systems include a socket for an Intel 80387 chip, but some lack support for the Weitek 3167.

Dual voltage on the power supply permits a computer's use in both the U.S. and Europe. All of these computers have this feature.

Number of device connectors indicates how many internal storage devices the system can support without the use of Y cables (power splitters).

FCC certification class The FCC (Federal Communications Commission) rates computers based on radio-frequency emission levels. A Class A rating signifies that a computer has sufficiently low emissions for operation in a business locale. The more stringent Class B rating allows home use as well, where computers are likely to be placed near radios and television sets.

CONTINUES

DATAWORLD INC.

Dataworld Data
386-33

by Bruce Brown

With a low price and a service-minded company behind it, the Dataworld Data 386-33 is a solid 33-MHz entry. This full-size FCC Class B-certified desktop ma-

chine has room for only five half-height drives; but if you don't hold that against it, the Data 386-33 is a strong choice.

Prices for the Data 386-33 start at \$1,980, which buys you 1MB of RAM, a 64K processor RAM cache, a 1.2MB floppy disk drive, a Hercules adapter and monochrome monitor, one parallel and two serial ports, and a 101-key keyboard. Our \$4,185 evaluation unit came more fully equipped, with 4MB of RAM, a 64K processor RAM cache, a 161MB Micro-

polis 16-millisecond ESDI hard disk, an UltraStor floppy/hard disk controller with a 32K buffer, a 1.2MB TEAC floppy disk drive, an Orchid ProDesigner II Super VGA board with 1MB of video RAM, a 14-inch Matsushita Super VGA interlaced monitor, one parallel and two serial ports, a Dataworld 101-key keyboard, and DOS 4.01.

Housed within the machine's 6.5- by 21- by 16-inch case is an Intel motherboard, complete with an Intel 386 chip set

COMPUTERS

33-MHz 386 PCs



33-MHz 386-BASED PCs: SUMMARY OF FEATURES

Products listed in alphabetical order by company name

	Amax Engineering Corp. Amax 386/33 Business Station	Arche Technologies Inc. Arche Legacy 386-33 Workstation	Austin Computer Systems Inc. Austin 386/33 Winstation	Blackship Computer Systems Inc. Blackship 386/33	Boss Technology Corp. Boss 3633-S	Bus Computer Systems Inc. Bus 386-33
Price of standard configuration	\$3,875.00	\$8,240.00	\$4,390.00	\$3,880.00	\$8,395.00	\$3,725.00
Distribution channel	Dealers	Dealers	Direct	Direct	Dealers	Direct
Case type	Tower	Desktop	Small-footprint	Desktop	Tower	Desktop
Dimensions (HWD, in inches)	25.5 x 7.3 x 17.5	6.5 x 21.3 x 16.5	6.5 x 16 x 16.5	6.5 x 21 x 16	25.5 x 7.5 x 17.8	6 x 21 x 16
Motherboard manufacturer	Amax	Arche	Austin	Micronics	AMI	ARMAS
386 chip set manufacturer	C&T	Discrete logic	OPTI	Discrete logic	C&T	Discrete logic
System RAM arrangement	Interleaved	Interleaved	Interleaved, page-mode	Interleaved, page-mode	Interleaved, page-mode	Interleaved, page-mode
Installable RAM (minimum-maximum)	1MB-16MB	4MB-32MB	1MB-32MB	1MB-16MB	1MB-64MB	4MB-64MB
MOTHERBOARD MEMORY						
Installed RAM	8MB	8MB	4MB	4MB	4MB	4MB
Maximum installable 32-bit RAM	8MB	8MB	32MB	16MB	64MB	64MB
RAM packaging (and rated speed)	DIP, SIMM (70 ns.)	SIMM (80 ns.)	SIMM (80 ns.)	SIMM (80 ns.)	SIMM (70 ns.)	SIMM (70 ns.)
Installed chip size	1Mb	2Mb	1Mb	1Mb	1Mb	1Mb
ADD-IN MEMORY BOARD						
Installed RAM	None	None	N/A	None	N/A	N/A
Maximum installable 32-bit RAM	8MB	24MB	N/A	16MB	N/A	N/A
RAM packaging (and rated speed)	DIP (70 ns.)	SIMM (80 ns.)	N/A	SIMM (80 ns.)	N/A	N/A
Installed chip size	N/A	N/A	N/A	N/A	N/A	N/A
Other chips supported	1Mb	256Kb, 1Mb	N/A	1Mb	N/A	N/A
PROCESSOR RAM CACHE						
Cache controller	Discrete logic	ProCache	OPTI	Intel	Discrete logic	Discrete logic
Installed RAM	64K	128K	128K	64K	64K	64K
RAM packaging (and rated speed)	DIP (15 ns.)	SIMM (20 ns.)	DIP (25 ns.)	DIP (25 ns.)	DIP (25 ns.)	DIP (25 ns.)
Installed chip size	16Kb	128Kb	128Kb	64Kb	64Kb	64Kb
BIOS						
BIOS version and date	AMI (April 1989)	Arche (March 1990)	Quadtel 3.05.03 (August 1990)	Phoenix 1.10 M6 (January 1988)	AMI Mk IV (August 1990)	AMI (December 1989)
Setup/password in ROM	■ / □	■ / ■	■ / □	■ / □	■ / □	■ / □
Video shadowing/Can be disabled	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
System shadowing/Can be disabled	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
HARD DISK						
Manufacturer	Maxtor	Maxtor	Imprimis	Maxtor	Seagate	NEC
Disk capacity	347MB	158MB	175MB	158MB	160MB	158MB
Interface	ESDI	ESDI	IDE	ESDI	ESDI	ESDI
Controller manufacturer	UltraStor	UltraStor	N/A	Western Digital	Western Digital	UltraStor
Integrated floppy/hard disk controller	■	■	■	■	■	■
Drive bays	6 half-height	5 half-height	3 half-height, 2 3.5-inch	5 half-height	4 half-height, 2 3.5-inch	5 half-height
Hard disk options	300MB, 600MB (ESDI); 105MB, 210MB (IDE); 600MB (SCSI)	380MB (ESDI); 100MB (IDE); 80MB (MFM)	40MB, 85MB, 110MB, 330MB, 660MB (ESDI)	150MB, 300MB, 600MB (ESDI); 40MB, 80MB, 105MB, 200MB (IDE); 150MB, 300MB, 600MB (SCSI)	330MB, 660MB (ESDI); 40MB, 80MB, 100MB, 200MB (IDE); 80MB, 157MB, 440MB, 570MB (SCSI)	110MB, 330MB, 670MB (ESDI); 40MB, 80MB, 100MB, 200MB (IDE)

■—Editors' Choice ■—Yes □—No

N/A—Not applicable: The product does not have this feature.

AMI—American Megatrends Inc., C&T—Chips and Technologies Inc., TI—Texas Instruments, VLSI Tech—Very Large Scale Integration Technologies Inc.

COMPUTERS

33-MHz 386 PCs

Club American Technologies Inc. Club Hawk I	Dataworld Inc. Dataworld Data 386-33	 Dell Computer Corp. Dell System 333D	Destiny Computers Destiny 386 1000	Digital Scientific Research Corp. DSR/Tiger 386	DTK Computer Inc. DTK Keen-3304	Dyna Micro Inc. Dyna Work Master 386 33 Plus
\$3,755.00	\$4,185.00	\$4,918.00	\$4,671.00	\$3,469.00	\$6,105.00	\$7,995.00
Direct	Dealers, direct	Direct	Dealers	Direct	Dealers, direct	Dealers
Tower	Desktop	Desktop	Desktop	Tower	Tower	Tower
25.5 x 8.8 x 20.5	6.5 x 21 x 16	6 x 16 x 16	6.5 x 18.8 x 16.8	18.5 x 6.5 x 16	22 x 7 x 19.8	25 x 9.5 x 18.5
Club	Intel	Dell	TMC	DSR	DTK	AMI
Discrete logic	Intel	VLSI Tech	OPTI	TI	Discrete logic	C&T
Page-mode	Page-mode	Interleaved, page-mode	Interleaved, page-mode	Interleaved, page-mode	Interleaved	Row/column
1MB-16MB	1MB-40MB	1MB-16MB	1MB-16MB	1MB-144MB	1MB-16MB	1MB-16MB
4MB	4MB	4MB	4MB	8MB	4MB	4MB
8MB	8MB	16MB	8MB	32MB	8MB	8MB
SIMM (80 ns.)	SIMM (80 ns.)	SIMM (80 ns.)	SIMM (70 ns.)	SIMM (80 ns.)	SIMM (70 ns.)	SIMM (70 ns.)
1Mb	1Mb	1Mb	4x256Kb, 1Mb	1Mb	1Mb	4x256Kb, 1Mb
None	None	N/A	None	None	None	None
8MB	32MB	N/A	8MB	96MB	8MB	8MB
SIMM (80 ns.)	SIMM (80 ns.)	N/A	SIMM (80 ns.)	SIMM (80 ns.)	SIMM (70 ns.)	DIP (70 ns.)
N/A	N/A	N/A	N/A	N/A	N/A	N/A
256Kb, 1Mb	256Kb, 1Mb	N/A	256Kb, 1Mb	256Kb, 1Mb, 4Mb	256Kb, 1Mb	1Mb
Discrete logic	Intel	Austek	OPTI	Intel	Discrete logic	Dyna Micro
64K	64K	64K	64K	64K	64K	64K
DIP (20 ns.)	DIP (25 ns.)	SIMM (25 ns.)	DIP (25 ns.)	DIP (25 ns.)	DIP (25 ns.)	DIP (20 ns.)
16Kb	64Kb	64Kb	8Kb	32Kb	64Kb	64Kb
AMI (April 1989)	Phoenix .1.10 16.H0 (August 1989)	Phoenix 80386 .1.0 A 02 (September 1990)	Award 3.05 (November 1989)	Quadtel 3.05.03 (August 1990)	DTK 4.26 (June 1990)	AMI (April 1990)
■ / □	■ / □	■ / ■	■ / □	■ / ■	■ / ■	■ / □
□ / □	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ ■
■ / ■	■ ■	■ / ■	■ ■	■ / ■	■ / ■	■ ■
Maxtor 158MB	Micropolis 161MB	Maxtor 190MB	Maxtor 170MB	Conner 204MB	Maxtor 158MB	CDC 182MB
ESDI	ESDI	IDE	ESDI	IDE	ESDI	ESDI
UltraStor	UltraStor	N/A	NCL	N/A	Adaptec	UltraStor
■	■	■	■	■	■	■
9 half-height	5 half-height	3 half-height, 1 3.5-inch	6 half-height, 2 3.5-inch	3 half-height, 3 3.5-inch	7 half-height	6 half-height, 1 full-height
330MB, 650MB (ESDI)	160MB, 322MB (ESDI); 43MB, 104MB, 209MB (IDE)	330, 650MB (ESDI); 40MB, 100MB (IDE)	150MB (ESDI); 40MB, 80MB (IDE); 300MB (SCSI)	300MB (ESDI); 100MB (IDE); 1GB (SCSI)	100MB (IDE); 320MB (SCSI)	300MB, 600MB (ESDI); 200MB (IDE)

CONTINUES

COMPUTERS

33-MHz 386 PCs

33-MHz 386-BASED PCs: SUMMARY OF FEATURES

Products listed in alphabetical order by company name

	Everex Systems Inc. Everex Step 386/33	Gateway 2000 Gateway 386-33 Cache	Micro Express Micro Express ME 386-33	National Micro Systems Inc. Flash 386-33	PC Brand Inc. PC Brand 386/33 Cache Desktop	PC Craft Inc. PC Craft 2401/33
Price of standard configuration	\$6,697.00	\$3,695.00	\$4,124.00	\$3,199.00	\$3,369.00	\$5,268.00
Distribution channel	Dealers	Direct	Direct	Direct	Direct	Dealers
Case type	Desktop	Desktop	Small-footprint	Desktop	Desktop	Tower
Dimensions (HWD, in inches)	6.3 x 21.3 x 16.5	5.3 x 21 x 16.5	7 x 15 x 16.3	6.4 x 21.1 x 16.5	6.5 x 18.9 x 15.9	24 x 6.8 x 16
Motherboard manufacturer	Everex	Micronics	AMI	AMI	Micronics	PC Craft
386 chip set manufacturer	Discrete logic	Micronics	C&T	C&T	Micronics	C&T
System RAM arrangement	Page-mode	Interleaved, page-mode	Interleaved, page-mode	Page-mode	Page-mode	Interleaved
Installable RAM (minimum-maximum)	2MB-16MB	1MB-16MB	1MB-16MB	1MB-64MB	1MB-16MB	1MB-16MB

MOTHERBOARD MEMORY

Installed RAM	4MB	4MB	4MB	4MB	4MB	N/A
Maximum installable 32-bit RAM	16MB	4MB	8MB	64MB	4MB	N/A
RAM packaging (and rated speed)	SIMM (100 ns.)	SIMM (70 ns.)	SIMM (80 ns.)	SIMM (70 ns.)	SIMM (80 ns.)	N/A
Installed chip size	2Mb, 3Mb, 4Mb	1Mb	1Mb	1Mb	1Mb	N/A

ADD-IN MEMORY BOARD

Installed RAM	N/A	None	None	N/A	None	4MB
Maximum installable 32-bit RAM	N/A	12MB	8MB	N/A	12MB	16MB
RAM packaging (and rated speed)	N/A	SIMM (70 ns.)	SIMM (80 ns.)	N/A	SIMM (80 ns.)	SIMM (80 ns.)
Installed chip size	N/A	N/A	N/A	N/A	N/A	1Mb
Other chips supported	N/A	256Kb, 1Mb, 4Mb	1Mb	N/A	256Kb, 1Mb	256Kb, 1Mb

PROCESSOR RAM CACHE

Cache controller	Everex	Intel	AMI	AMI	Intel	Intel
Installed RAM	64K	64K	64K	64K	64K	32K
RAM packaging (and rated speed)	SIMM (35 ns.)	DIP (25 ns.)	DIP (25 ns.)	DIP (15 ns.)	DIP (25 ns.)	DIP (20 ns.)
Installed chip size	64Kb	8Kb	64Kb	64Kb	8Kb	32Kb

BIOS

BIOS version and date	AMI (January 1990)	Phoenix 1.10 Mk8 (1990)	AMI (July 1990)	AMI (April 1990)	Phoenix 1.10 M8 (August 1990)	AMI KX490DX (May 1990)
Setup/password in ROM	■ / □	■ / □	■ / □	■ / □	■ / □	■ / □
Video shadowing/Can be disabled	□ / □	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
System shadowing/Can be disabled	■ / ■	■ / ■	■ / ■	■ / □	■ / ■	■ / ■

HARD DISK

Manufacturer	Imprimis	Seagate	Imprimis	Seagate	Seagate	Maxtor
Disk capacity	160MB	150MB	150MB	150MB	143MB	203MB
Interface	ESDI	ESDI	ESDI	ESDI	IDE	SCSI
Controller manufacturer	Everex	UltraStor	DPT	Western Digital	N/A	Always Technology
Integrated floppy/hard disk controller	■	■	■	■	■	■
Drive bays	5 half-height	5 half-height, 3 3.5-inch	3 half-height	5 half-height	6 half-height	6 half-height
Hard disk options	90MB, 330MB, 600MB (ESDI)	110MB, 300MB, 650MB (ESDI)	100MB, 300MB, 600MB (ESDI)	300MB (ESDI); 100MB, 200MB (IDE)	40MB, 89MB (IDE); 320MB (ESDI); 125MB, 178MB, 200MB (IDE)	150MB, 300MB (ESDI); 200MB, 300MB (SCSI)

■—Editors' Choice ■—Yes □—No

N/A—Not applicable: The product does not have this feature.

AMI—American Megatrends Inc., C&T—Chips and Technologies Inc., TI—Texas Instruments, VLSI Tech—Very Large Scale Integration Technologies Inc.

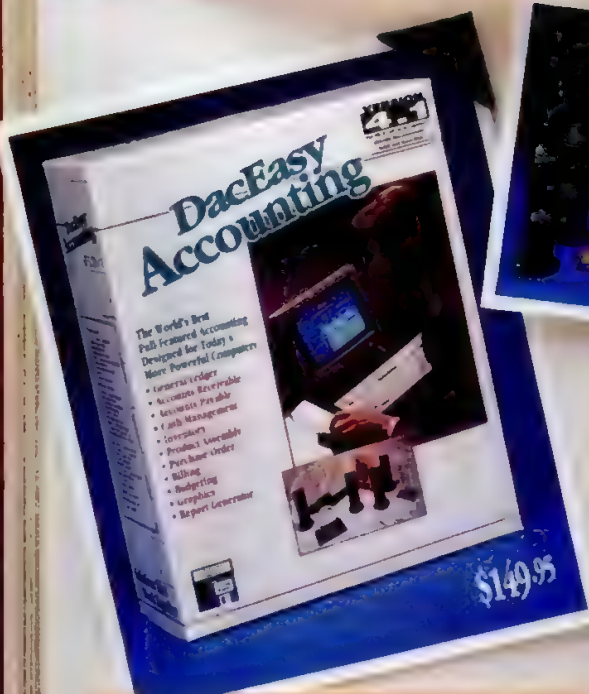
COMPUTERS

33-MHz 386 PCs

Polywell Computers Inc. Poly 386-33PT	Spear Technology Inc. Spear Ultra 386/33	Tandy Corp. Tandy 4033 LX	Tangent Computer Inc. Tangent 333c	Tri-Star Computers Corp. Tri-Star 386/33	 Zeos International Ltd. Zeos 386-33	Zodiac Technologies FiveStar 386/33
\$4,550.00 Dealers, direct	\$4,410.00 Dealers, direct	\$8,716.75 Dealers, direct	\$3,784.00 Direct	\$3,564.00 Direct	\$4,470.00 Direct	\$4,495.00 Direct
Tower 25 x 8.8 x 20.3 Polywell Discrete logic Row/column 1MB-32MB	Desktop 6.5 x 21.2 x 6.5 Everex Discrete logic Row/column 1MB-16MB	Small-footprint 6.3 x 17 x 15.3 Tandy C&T Interleaved, page-mode 4MB-16MB	Desktop 21 x 6.5 x 16.5 Atronics Discrete logic Interleaved 1MB-16MB	Tower 25.5 x 8 x 18 Tri-Star Discrete logic Row/column 1MB-16MB	Tower 24.5 x 7.5 x 17.5 Mylex Discrete logic Page-mode 1MB-32MB	Desktop 6.8 x 21.5 x 16.3 Zodiac Discrete logic Interleaved, page-mode 1MB-32MB
4MB 32MB SIMM (70 ns.) 1Mb	4MB 8MB SIMM (80 ns.) 1Mb	N/A N/A N/A N/A	4MB 8MB SIMM (70 ns.) 1Mb	4MB 8MB SIMM (80 ns.) 1Mb	4MB 32MB SIMM (80 ns.) 1Mb	4MB 8MB SIMM (80 ns.) 1Mb
N/A N/A N/A N/A N/A	None 8MB SIMM (80 ns.) N/A 256Kb, 1Mb	4MB 16MB SIMM (100 ns.) 4x256Kb, 1Mb 1Mb	None 8MB DIP (70 ns.) N/A 1Mb	None 8MB SIMM (80 ns.) N/A 256Kb, 1Mb	N/A N/A N/A N/A N/A	None 8MB SIMM (80 ns.) N/A 256Kb, 1Mb
Discrete logic 64K DIP (15 ns.) 16Kb	Discrete logic 64K DIP (20 ns.) 8Kb	Intel 32K DIP (20 ns.) 64Kb	Discrete logic 64K DIP (25 ns.) 64Kb	Discrete logic 64K DIP (20 ns.) 64Kb	Discrete logic 128K DIP (25 ns.) 256Kb	Discrete logic 64K DIP (20 ns.) 64Kb
Phoenix 1.10.01 (April 1990) ■ / □ ■ / ■ ■ / ■	AMI F1S-39 (October 1989) ■ / □ ■ / ■ ■ / ■	Phoenix 3.10.10 (December 1989) ■ / ■ ■ / □ ■ / □	AMI 3.0 (April 1990) ■ / □ ■ / ■ ■ / ■	AMI 095173 (April 1990) ■ / □ □ / □ □ / □	Phoenix 1.10.10 (October 1989) ■ / □ ■ / ■ ■ ■	AMI (April 1990) ■ / □ □ / □ □ / □
Maxtor 158MB ESDI DTC ■ 2 full-height, 5 half-height 150MB, 200MB, 337MB, 600MB, 2.5GB (ESDI); 337MB, 600MB, 2.5GB (SCSI)	Toshiba 141MB ESDI DTC ■ 5 half-height 330MB (ESDI); 150MB, 330MB (SCSI)	Seagate 168MB SCSI Adaptec ■ 2 half-height, 2 3.5-inch 52MB, 105MB (IDE); 40MB, 80MB, 170MB, 440MB (SCSI)	Imprimis 160MB ESDI UltraStor ■ 5 half-height 345MB, 670MB (ESDI); 345MB, 670MB (SCSI)	Maxtor 200MB IDE N/A ■ 6 half-height 300MB, 600MB (ESDI)	Imprimis 160MB ESDI Adaptec ■ 6 half-height, 1 3.5-inch 94MB, 337MB, 674MB (ESDI); 44MB, 71MB, 89MB, 124MB, 204MB (IDE); 80MB, 160MB, 337MB, 674MB, 1.1GB (SCSI)	Micropolis 150MB ESDI UltraStor ■ 5 half-height 337MB, 674MB (ESDI); 200MB (IDE)

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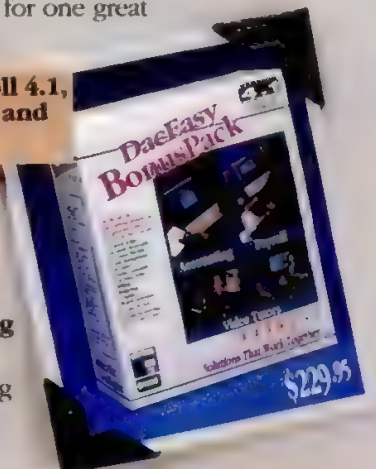


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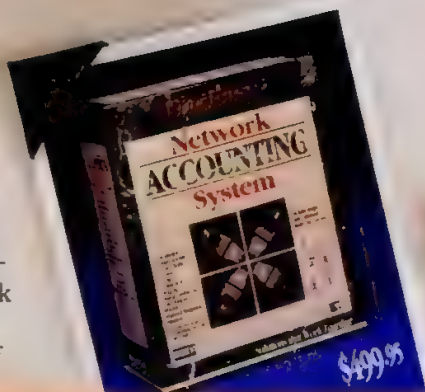
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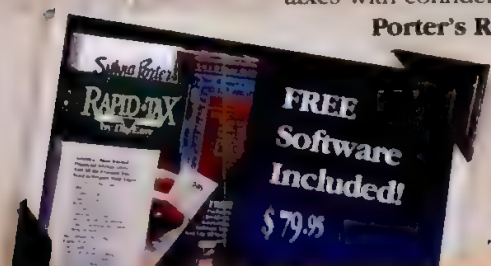


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Circle 110

COMPUTERS

33-MHz 386 PCs



33-MHz 386-BASED PCs: SUMMARY OF FEATURES

Products listed in alphabetical order by company name

	Amax Engineering Corp. Amax 386/33 Business Station	Arche Technologies Inc. Arche Legacy 386-33 Workstation	Austin Computer Systems Inc. Austin 386/33 Winstation	Blackship Computer Systems Inc. Blackship 386/33	Boss Technology Corp. Boss 3633-S	Bus Computer Systems Bus 386-33
FLOPPY DISK DRIVES						
Type	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB	1.2MB	1.2MB, 1.44MB	1.2MB, 1.44MB
Manufacturer	TEAC	TEAC	Chinon	TEAC	TEAC	TEAC, Sony
EXPANSION BUS						
Bus speeds (MHz)	8	8, 11	8	8, 11	8	8
Slots (8-, 16-, 32-bit)	1, 6, 1	0, 6, 2	1, 6, 0	0, 7, 1	0, 6, 2	1, 7, 0
Slots free in fully configured PC	5	5	6	5	5	4
Ports originate on motherboard	☐	☐	☒	☐	☐	☐
VIDEO						
Display circuitry location	Card	Card	Card	Card	Card	Card
Manufacturer	Orchid	Arche	Austin	Orchid	Cardinal	Bus
Chip set manufacturer	Tseng	Tseng	Tseng	Tseng	C&T	Trident
KEYBOARD/MOUSE						
Keyboard manufacturer	Maxi-Switch	Hi-Tek	Chicony	Key Tronic	Honeywell	Chicony
Number of keys, function keys	101, 12	101, 12	101, 12	101, 12	101, 12	101, 12
Keyboard cable length (inches)	60	100	60	60	60	60
Mouse port	☐	☐	☐	☐	☐	☐
SOFTWARE AVAILABLE						
DOS	3.3, 4.01 (\$99)	3.3, 4.01 (\$159)	4.01	3.3, 4.01 (\$85)	3.3, 4.01	4.01
OS/2	1.1 (\$699)	None	None	None	None	1.1 (\$300)
Disk caching software	☐	☐	☐	☐	☐	☐
Expanded memory manager	☐	☐	☐	☒	☒	☒
Other software included	None	None	Windows 3.0	None	None	None
MISCELLANEOUS						
Weitek 3167 support	☒	☒	☐	☒	☒	☒
Physical features:						
Power supply (watts)	300	200	200	230	300	200
Number of device connectors	4	4	5	4	4	4
Keyboard/case lock	Front/none	Front/none	Front/front	Front/none	Front/none	Front/none
Power-on/reset switch	Front/front	Side/front	Back/front	Side/front	Front/front	Side/front
Warranty	1 year	2 years	1 year	1 year	2 years motherboard, 3 years keyboard	1 year
Service	Dealer	30 days on-site; dealer or vendor	On-site	Vendor	Vendor	On-site
FCC certification class	A	B	B	B	A	A

☒—Editors' Choice☒—Yes☐—No

COMPUTERS

33-MHz 386 PCs

Club American Technologies Inc. Club Hawk I	Dataworld Inc. Dataworld Data 386-33	 Dell Computer Corp. Dell System 333D	Destiny Computers Destiny 386 1000	Digital Scientific Research Corp. DSR/Tiger 386	DTK Computer Inc. DTK Keen-3304	Dyna Micro Inc. Dyna Work Master 386 33 Plus
1.2MB TEAC	1.2MB TEAC	1.2MB, 1.44MB Sony, Mitsubishi	1.2MB Chinon	1.2MB, 1.44MB Epson	1.2MB, 1.44MB Mitsumi	1.2MB, 1.44MB TEAC
5.5, 8.25 1, 6, 1 5 ■	8 1, 5, 2 6 ■	8 1, 5, 0 6 ■	8.33 1, 6, 1 5 □	8 1, 6, 1 6 □	8 1, 6, 1 5 □	8 2, 6, 1 5 □
Card Club Tseng	Card Orchid Tseng	Motherboard NEC WD	Card BTC Paradise	Card DSR Trident	Card ATI ATI	Card Orchid Tseng
Key Tronic 101, 12 144 □	Dataworld 101, 12 72 □	Alps 101, 12 60 ■	BTC 101, 12 70 □	Maxi-Switch 101, 12 60 ■	Key Tronic 101, 12 72 □	MTEC 101, 12 60 □
4.01 None □ J Windows 3.0	3.3, 4.01 (\$70) None □ □ None	3.3 (\$100), 4.01 (\$119) 1.1 (\$299) □ ■ None	3.3, 4.01 (\$99) None □ □ None	4.01 None □ □ Windows 3.0	4.01 None □ □ Windows 3.0	None None □ □ None
■	■	■	■	■	■	■
250 7 Front/back Front/front 1 year Vendor B	200 4 Front/none Side/front 1 year On-site B	177 5 None/back Front/front 1 year On-site B	200 4 Front/none Front/front 1 year 90 days on-site; dealer or vendor A	200 4 Front/none Front/front 1 year Vendor A	200 5 Front/none Front/front 1 year Dealer B	250 6 Front/none Front/front 1 year On-site A

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Products listed here in red are Microsoft
Windows Applications.

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- 7547 □ Adobe Type Manager for Windows \$59.
 - 8367 □ ATM & Plus Pack Bundle 169.
 - 7392 □ Adobe PostScript Cartridge 249.
- (Entire Adobe Type Library, from 1 to 133
is available. Call for more information.)

Aldus ... NCP

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- 8000 □ Persuasion 2.0 for Windows. 399.

Alpha Software ... NCP

- 5104 □ Alpha Four 1.1 319.



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386MAX & BlueMAX let you run your 386
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7967 BlueMAX 1.0 (3 1/2" only) 85.

Application Techniques ... NCP

- 1214 □ Pizazz Plus 2.0 \$69.

Ashton-Tate ... NCP

- 4450 □ dBASE IV 1.1 499.

Asymetrix ... NCP

- 7384 □ Toolbook 1.0 for Windows 309.

Avery ... NCP

- 6006 □ Label Pro 1.0 (Laser) 49.

- 7336 □ Label Pro 1.0 for Dot Matrix 49.

Bitstream ... NCP

- 7568 □ FaceLift 1.0 for Windows 2.x/3.0 . 59.

- 8368 □ FaceLift 1.0 & Microsoft Windows
Productivity Pack 1.0 99.

- Collections: each 129.

- Typeface Packages each 89.

Bloc Publishing ... NCP

- 1447 □ FormTool Gold 3.0 55.

- 6245 □ Pop Drop Plus 1.0 59.

Borland International ... NCP

- 7357 □ Turbo C++ 1.0 Professional 219.

- 7356 □ Turbo Pascal Professional 2nd Ed. 179.

- 6242 □ Quattro Pro 2.0 339.

- 1514 □ Paradox 3.5 569.



Adobe Systems ... NCP

8367 □ ATM & Adobe Plus Pack Bundle—ATM
converts Windows 3.0 screen displays &
dot-matrix printed output to crisp, legible
text at any point size. The Plus Pack includes
22 additional PostScript fonts \$169.

Broderbund ... NCP

- 1434 □ New Print Shop 39.

ButtonWare ... NCP

- 6419 □ PC-File 5.0 89.

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- 6004 □ Omnipage 386 2.1 599.

Central Point ... NCP

- 5039 □ PC Tools Deluxe 6.0 95.

- 8114 □ Backup 6.0 65.

Chipsoft ... NCP

- 1663 □ TurboTax 8.0 for 1990 Taxes 45.

CompuServe

- 7546 DOS Membership Kit 23.

Concentric Data Systems ... NCP

- 6575 □ R & R Relational Report Writer 3B 109.

Corel Systems ... NCP

- 5506 □ CorelDRAW! 2.0 389.

Custom Applications ... NCP

- 7474 □ Freedom of Press 2.2 255.

Data Storm ... NCP

- 4798 □ PROCOMM PLUS 1.1 65.



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5506 □ CorelDRAW! 2.2—The award-winning
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- 2908 □ Crosstalk XVI 3.71 119.

- 5611 □ Crosstalk for Windows 1.1 129.

Delrina Technology ... NCP

- 7351 □ PerFORMPRO 1.0 for Windows. 299.

Fifth Generation Systems ... NCP

- 7725 □ Direct Access 5.0 65.

- 7795 □ Disklock 1.0 109.

- 3950 □ Fastback Plus 2.1 119.

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- 5810 □ FormWorx with Fill & File 2.5 85.

- 7311 □ Form Publisher for Windows 1.2. 145.

Fox Software ... NCP

- 6188 □ FoxPro 1.02 489.

Franklin Software ... NCP

- 7071 □ Language Master 3.0 49.

- 7416 □ Language Master 3.0 for Windows 59.

Funk Software ... NCP

- 2228 □ Sideways 3.3 59.

- 7380 □ P.D. Queue 1.0 (print spooler) ... 59.



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- 7983 ☐ Smartcom Exec 2.0 79.
 2295 ☐ Smartcom III 1.2 149.
- hDC Computer Corp. ... NCP**
- 7389 ☐ Windows Express 3.0 52.
 7383 ☐ First Apps 1.0 52.
- Hillgraeve ... NCP**
- 2323 ☐ HyperACCESS/5 1.1 (DOS & OS/2) 115.
- IBM ... NCP**
- 6599 ☐ Current 1.1 239.
- Individual Software ... NCP**
- 6222 ☐ Resume Maker 1.1 29.
- Inset Systems ... NCP**
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 5653 ☐ 1-2-3 2.2 349.
 5134 ☐ Magellan 2.0 119.
- MECA ... NCP**
- 4603 ☐ Andrew Tobias' Tax Cut-1990 Taxes 49.
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 7387 ☐ PowerPoint for Windows 1.0. 329.
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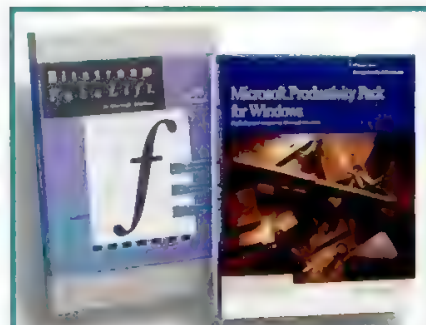
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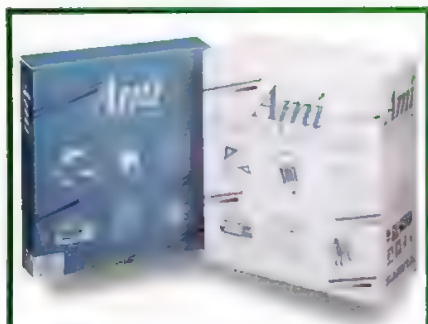
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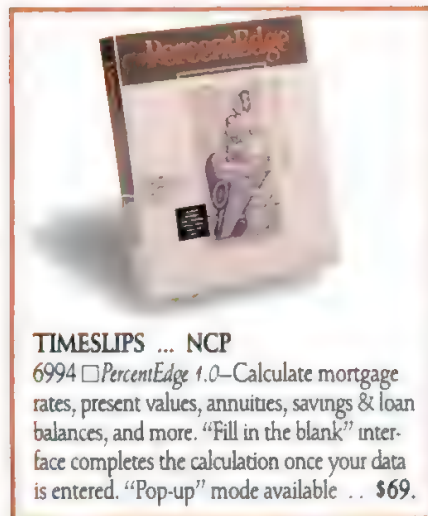
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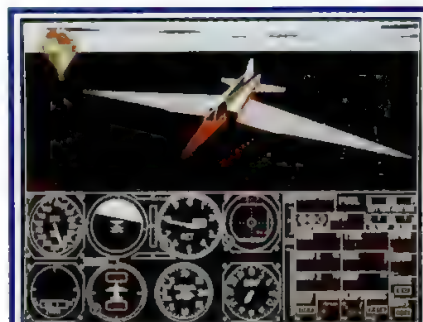
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6889 ☐ MicroPhone II for Windows. . . . 215.
Solution Systems ... NCP
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Spinnaker ... NCP
7604 ☐ PLUS for Windows 1.0 289.
Symantec ... NCP
3152 ☐ The Norton Commander 3.0 . . . 105.
6397 ☐ The Norton Backup 1.1 105.
3146 ☐ The Norton Utilities 5.0 125.
3425 ☐ Q&A 3.0 229.
Systems Compatibility ... NCP
8215 ☐ Outside In 1.0 65.
6564 ☐ Software Bridge 4.1 79.
TIMESLIPS ... NCP
2987 ☐ Timeslips III 4.0 195.
6994 ☐ PercentEdge 1.0 69.
Timeworks ... NCP
6253 ☐ Publish-It! 1.1 115.
Touchstone Software ... NCP
7420 ☐ Check It 3.0 89.



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5179 ☐ LapLink III 3.0 \$95.
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7796 ☐ Ventura Publisher for Windows 3.0 569.
West Lake Data Corp. ... NCP
7577 ☐ PC-FullBak+ 1.12 52.
7574 ☐ PathMinder+ 1.0 79.
WordPerfect Corp. ... NCP
7781 ☐ LetterPerfect 1.0 135.
3804 ☐ WordPerfect 5.1 265.
6685 ☐ DrawPerfect 1.1 279.
WordStar International ... NCP
6791 ☐ WordStar Prof. 6.0 279.
XTREE ... NCP
6161 ☐ XTreePro Gold 1.4 85.
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RECREATIONAL/EDUCATIONAL

- Broderbund ... CP**
8068 ☐ Where in the World is Carmen Sandiego Deluxe Edition 52.
5851 ☐ SimCity 33.
Electronic Arts ... NCP
5804 ☐ Deluxe Paint II (Enhanced) 89.
Microsoft ... NCP
7881 ☐ Entertainment Pk for Windows 1.0 29.
8270 ☐ Aircraft and Scenery Designer 1.0 (req. FS 4.0) 29.
2858 ☐ Flight Simulator 4.0 39.
Microsoft Press (Books)
8126 Running with DOS 4th Edition. . . . 20.
8129 Running Windows (2nd Edition) . . . 22.
8136 Running Microsoft Excel 22.
Penton Overseas ... NCP
☐ VocabuLearn/ce Levels I & II (French, Italian, German, Spanish, Russian, Hebrew and Japanese). . . . each 39.
Sierra On-Line ... CP
5106 ☐ Space Quest III 39.
7972 ☐ King's Quest V 45.



Touchstone Software ... NCP

7420 ☐ Check It 3.0—Diagnostic software will help find and get rid of system problems. Run over 160 tests on all major system components. Results can be logged to disk or printer with suggestions on fixing simple troubles .. \$89.

- Spectrum Holobyte ... NCP**
3467 ☐ Tetris 22.
5993 ☐ Welltris. . . . 22.
Software Toolworks ... NCP
4659 ☐ Chessmaster 2100 (CP) 35.
7372 ☐ World Atlas 42.
Stone & Assoc. ... NCP
5231 ☐ Phonics Plus 22.
3433 ☐ Algebra Plus Vol 1 (ages 13+) . . . 27.
Toyogo ... NCP
7676 ☐ Nemesis Go Master Deluxe 88.
True BASIC, Inc. ... NCP
☐ Kemeny/Kurtz Math Series. each 45.

HARDWARE

Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

- American Power ... 2 years**
7108 Smart UPS 400. . . . 339.
6811 360SX (stand-by power source) . . . 219.
7106 520ES (stand-by power source) . . . 329.
AST Research ... 2 years
1299 SixPakPlus 384k C/S/P 179.
8041 SixPak 286 0k. . . . 105.
Boca Research ... 5 years
7001 BOCARAM/AT PLUS (0-8 Meg) (LIM 4.0 extended) 125.
7061 BOCARAM/XT 0K (0-2 Meg, LIM 4.0) 99.
6998 I/O Board for AT 59.
8380 BasicVGA (256K 640 x 480) 79.
8381 SuperVGA (1 Meg 1024 x 768) . . . 145.
Bravo Communications ... 2 years
7400 2 Pos. Laser Compatible Switch Box 109.
Canon ... 1 year
7894 BJ-10e BubbleJet Printer (4.6 lb.) . 349.
7896 Sheet feeder for BJ-10e 75.
CH Products ... 1 year
8119 FlightStick w/Falcon & GameCard III . 79.
7345 RollerMouse (Trackball) serial 85. bus 99.

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and memory would do.



Systems Compatibility ... NCP
8215 **Outside In 1.0**—Import text or data directly into your word processor from over 50 different word processor, spreadsheet, and database programs—without leaving your word processor. \$65.

Curtis ... lifetime

- 1704 Universal Printer Stand PS-1 18.
- 1708 Ruby-Plus SPF-2 Plus 65.
- 7358 Command Center 89.
- Glass Filter Plus (specify size) .. ea. 65.

Datadesk ... 3 years

- 6901 Switchboard 175.

Epson ... 1 year

We are an authorized Epson Service Center.

- 1906 FX-850 (80 col., 264 cps, 9 pin) ... call
- 1904 FX-1050 (136 col., 264 cps, 9 pin) ... call
- 5183 LQ-510 (80 col., 180 cps, 24 pin) ... 289.
- 1930 LQ-850 (80 col., 264 cps, 24 pin) ... call
- 1917 LQ-1050 (136 col., 264 cps, 24 pin) call
- 5184 LX-810 (80 col., 180 cps, 9 pin) ... 185.
- 7775 Equity LT-286e Laptop 1995.
- 7774 Equity LT-386SX Laptop 3069.

5th Generation ... 1 year

- 7157 Logical Connection Plus 512k 599.

Hayes ... 2 years

- 2307 Smartmodem 2400. 349.
- 8049 JTFax 9600B 499.
- 7391 Ultra 9600 Modem 829.

Hewlett-Packard ... 1 year

- 6754 LaserJet III (w/toner) 1699.
- 6582 LaserJet IIP (w/toner) 1069.

Intel ... 5 years

- 6421 2400B MNP Internal Modem 199.
- 4696 2400B Internal Modem 159.
- 2352 2400B Internal Modem 2 (for PS/2) 249.
- 5119 2400 Baud External Modem 179.
- 6420 2400EX MNP Modem 229.
- 7880 9600EX Modem 549.
- 2346 Inboard 386/PC w/1 Meg 495.
- 5336 Above Board Plus 8 2 Meg 599.
- 5342 Above Board Plus 8 I/O 2 Meg ... 629.
- 7782 SatisFAXtion (fax board) 399.
- 7552 NetPort (3 year warranty). 489.

MATH COPROCESSORS

- 7385 80287XL (16 MHz 80286 CPU's) ... 199.
- 4750 80387SX (16 MHz 80386SX CPU's) 309.
- 2371 80387 (16 MHz 80386 CPU's) 349.
- 2372 80387-20 (20 MHz 80386 CPU's) 399.
- 4121 80387-25 (25 MHz 80386 CPU's) 429.

Kensington Microware ... 1 year

- 2582 Master Piece Plus \$109.
- 7899 Expert Mouse serial ... 119. bus ... 129.

Keytronic ... 3 years

- 4518 101 Plus Keyboard 99.

Kraft ... 5 years

- 5800 3 button Thunder Joystick. 29.
- 5813 Game Card/Thunderstick Bundle .. 55.
- 7862 TopTrack (Laptop Trackball) 79.

Logitech ... limited lifetime

- 7768 C9 Mouse with Windows. 149.
- 6029 Trackman (Trackball) serial 85. bus 89.
- 4297 ScanMan Plus (hand scanner) ... 185.
- 7975 ScanMan 256 319.

Micron Technology ... 2 years

- 7595 2 Meg Expansion for HP LaserJet IIP or IIP 165.
- 7012 Beyond Memory Board for PS/2 Model 70 (2 Meg) 169.

Microsoft ... lifetime

- 7597 Microsoft Mouse 89.
- 2897 Mouse with Paintbrush 109.
- 2898 Mouse with Windows 3.0 149.



Insight Development ... NCP

8320 **PrintTools 1.0**—Utilities for the HP LaserJet, DeskJet & compatibles. Includes Spooler, Screen Dump, Screen Capture, SetUp, Plot with HPGL/2 support, and Help utilities \$85.

MicroSpeed ... 1 year

- PC-TRAC Trackball
- 6007 serial 75. 6008 bus 89.
- 7271 Inport 79. 6330 PS/2 79.

Mouse Systems ... lifetime

- 5997 Trackball (1 yr. wrnty.) serial 75. bus 85.
- 7878 PC Mouse III 99.

NEC ... 2 years

- 4799 Multisync 2A (VGA Monitor) 499.
- 5085 Multisync 3D Monitor 689.

Orchid Technologies ... 4 years

- 7512 ProDesigner VGA II (1024 x 768) .. 299.
- 7888 ProDesigner/e (256k) 209.

1-800/243-8088



PC Connection

800M

6 Mill Street
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SALES 603/446-7721 FAX 603/446-7791



Boca Research ... 5 years

SuperVGA by Boca—High-performance VGA upgradeable 1024 x 768 graphics in 256 colors. Interlaced & non-interlaced compatible.
6995 1024 x 768/16 Colors (512K) \$139.
8381 1024 x 768/256 Colors (1 Meg) 145.

PC Power & Cooling ... 1 year

REPLACEMENT POWER SUPPLIES

- 3202 Turbo Cool 150 (25° - 40° cooler) . 129.
- 7915 Turbo Cool 300 165.
- 3200 Silencer 150 (84% noise reduction) 115.

Pacific Data Products ... 1 year

- 6779 25 Cartridges in One! (for LJ II, IIP, III) 275.
- Memory upgrade for LaserJet IIP/III
- 7054 1 Meg ... 149. 7055 2 Meg ... 199.
- 7758 3 Meg ... 279. 7759 4 Meg ... 339.
- 7158 Pacific Page 4.0 (for LaserJet IIP/III) 379.
- 6834 Pacific Page with free 2 Meg Memory Board (for LaserJet II) ... 379.

Practical Peripherals ... 5 years

- 3103 2400 Baud Internal Modem 135.
- 3102 2400 Baud External Modem 179.
- 5286 2400 Baud Int. MNP Modem (Lex. 5) 175.
- 5285 2400 Baud Ext. MNP Modem (Lex. 5) 209.
- 4542 2400 Baud Internal Modem for PS/2. 229.
- 8132 PM2400 Pocket Modem 99.
- 7934 PM9600SA 489.



Practical Peripherals ... 5 years

7934 **PM9600SA Modem**—Practical Peripherals does it again by making communications affordable with their newest modem featuring the data compression & error correction of 9600bps V.32 & V.42bis operation ... \$489.

PC CONNECTION®

* DEFECTIVE SOFTWARE REPLACED IMMEDIATELY. DEFECTIVE HARDWARE REPLACED OR REPAIRED AT OUR DISCRETION.

Happy New Year.

PSION ... 1 year

7086	MC600 Mobile Computer	2149.
7090	512K Flash EPROM	309.
7962	3 1/2" External Drive	299.
Reflection Technology ... 1 year		
7127	Private Eye (virtual display)	499.
SAFE Power Systems ... 2 years		
7913	Safe 650W	459.
Targus ... lifetime		
6037	Premier Leather Carrying Case	199.
TheComplete PC ... 2 years		
8082	TheComplete Half Page Scanner/400 w/ReadRight Personal OCR Software	289.
6797	TheComplete Fax Portable	319.
5828	TheComplete Communicator	449.
Tripp Lite ... 2 years		
6199	Isobar 4-6 (4 outlets, 6 ft. cord)	49.
6200	Isobar 6-6 (6 outlets, 6 ft. cord)	59.
Video 7 ... 7 years		
5883	1024i VGA (includes 512k)	219.
4931	VRAM VGA 512k	379.

2286	30 Meg Int. Hard Drive ST238R (w/controller and cables, 65 ms)	\$269.
4554	40 Meg Int. HD ST251-1 (28 ms)	329.
TEAC ... 1 year		
4951	720k Drive (specify XT or AT, 3 1/2")	75.
4670	1.44 Meg Drive for PC/XT (3 1/2")	89.
4326	1.44 Meg Drive for AT	109.

MEMORY

6556	256k DRAMs (100 ns, set of 9)	\$29.
5510	1 Meg x 9 SIMMs (80 nanosecond)	69.
5746	1 Meg Chips (80 ns, set of 9)	69.

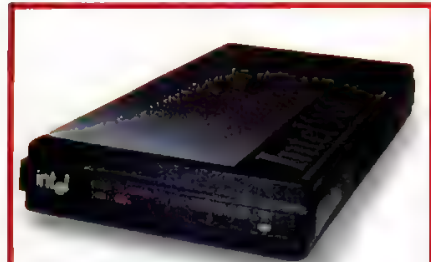
OUR POLICY

- We accept VISA and MASTERCARD only.
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- COD max. \$1000. Cash, cashier's check, or money order.
- 120 day limited warranty on all products.*
- To order, call us Monday through Friday 8:00 AM to 1:00 AM, or Saturday 9:00 AM to 5:30 PM. You can call our business offices at 603/446-3383 Monday through Friday 9:00 AM to 5:30 PM.



Intel ... 5 years

80287XL & 80287XLT Math CoProcessors—Runs up to 50% faster than other 80287 math chips. The 80287XL works in virtually every 80286-based PC, and the 80287XLT is made especially for Compaq LTE/286.. each \$199.



Intel ... 5 years

7880 9600EX Modem—Provides ultra-fast data communications without sacrificing compatibility. Supports V.32 & V.42bis 9600 bps operation, as well as MNP Level/5 and Hayes compatible 2400/1200/300 bps modes. \$549.



Intel ... 5 years

7782 SatisFAXtion—Send and receive faxes from within most applications using the print command. Built-in 2400 bps MNP modem standard. Includes coupons for free PC Tools and Fax-It software. \$399.



Ashton-Tate ... NCP

6922 MultiMate 3.31—Upgrade to MultiMate 4.0 through Ashton-Tate for \$79.50. Total cost \$121.50 including shipping. Save over \$400 on list price of \$565. Call for details \$39.

DRIVES

IOMEGA ... 1 year

7551	Bernoulli II Transportable 44 Meg	997.
5113	44 Meg Cartridge Tripak (5 1/4")	249.
2500	PC2B Controller	229.
Mountain Computer ... 2 years		
2917	40-60 Meg Internal Tape Drive	259.
5500	80-152M Int. Tape Drive	629.
5190	DC2000 Pre-formatted Cartridges ea.	35.
6153	DC2120 Tape Cartridge (5 pack)	135.
Pacific Rim ... 1 year		
5010	1.2 Meg External (for PS/2's)	215.
6602	1.44 Meg External (for PC/XT/AT)	239.
Plus Development ... 2 years		
6424	Hardcard II 80 Meg (19 ms)	599.
8304	Hardcard II XL 50 Meg (9 ms)	399.
8287	Hardcard II XL 105 Meg (9 ms)	689.
Seagate ... 1 year		
2285	20 Meg Int. Hard Drive ST225 (w/controller and cables, 65 ms)	255.

DISKS

Maxell ... lifetime

2789	5 1/4" MD2-D 360k Disks (Qty. 10)	12.
2790	5 1/4" MD2-HD 1.2Mb Disks (Qty. 10)	19.
2792	3 1/2" DS/DD 720k Diskettes (Qty. 10)	14.
2793	3 1/2" DS/HD 1.44Mb Diskettes (Qty. 10)	27.
Sony ... lifetime		
3291	5 1/4" DS/DD 360k Disks (Qty. 10)	10.
3292	5 1/4" DS/HD 1.2Mb Disks (Qty. 10)	19.
3297	3 1/2" DS/DD 720k Diskettes (Qty. 10)	13.
3298	3 1/2" DS/HD 1.44Mb Diskettes (Qty. 10)	22.
8185	QD 2040 Tape Cartridge	19.

SHIPPING

Note: Accounts on net terms pay actual shipping.

Continental US:

- For heavy hardware items such as printers, monitors, Bernoulli Boxes, etc. pay actual charges. Call for UPS 2nd-Day & Next-Day-Air.
- For all other items, add \$3 per order to cover UPS Shipping. For such items, we automatically use Airborne Express at no extra charge if you are more than 2 days from us by UPS ground.

Hawaii:

- For monitors, printers, Bernoulli Boxes, computers, hard drives, and power backups, actual UPS Blue charge will be added. For all other items, add \$3 per order.

Alaska and outside Continental US:

- Call 603/446-7721 for information.

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PC Chronicles.

Call me a lyre.

(Or, how we wrote the book on PC mail order.)

Truth tends to be stranger than fiction in the telltail town of Marlow, NH (pop. 564). That's why you'll often find the local color gathered 'round the ancient sage as he recounts in vivid detail how our forest glade was transformed into a PC paradise.

For, in days of yore, buying software and peripherals by mail was a perilous task, fraught with danger and uncertainty. Only those well versed in the black arts dared risk such unpredictable delivery and uncertain compatibility.

Then one day the enlightened Order of the Connection appeared majestically on the scene, bringing

the classic virtues of toll-free tech support, prompt shipping, and way-under-retail prices to the brave new world of the IBM PC. Since that glorious day our humble home has served as a beacon of light to noble users in cottages, condos, and corporations throughout America. **That'll be the day.**

It's not every day of the week you get offered your very own 1991 PC Connection Calendar. This very timely offer includes 13 classic illustrations of our legendary mascots, all your favorite holidays, and fascinating historical facts about the fiefdom of Marlow, NH. This wondrous wall calendar is free to everyone who places an order of \$750 or more between now and February 28.



Mark time with the PC Connection Calendar featuring our very own day-tripping mascots. Offer not available to accounts on net terms. One per customer.

PC CONNECTION

COMPUTERS
33-MHz 386 PCs



33-MHz 386-BASED PCs: SUMMARY OF FEATURES

Products listed in alphabetical order by company name

	Everex Systems Inc. Everex Step 386/33	Gateway 2000 Gateway 386-33 Cache	Micro Express Micro Express ME 386-33	National Micro Systems Inc. Flash 386-33	PC Brand Inc. PC Brand 386/33 Cache Desktop	PC Craft Inc. PC Craft 2401/33
FLOPPY DISK DRIVES						
Type	1.2MB	1.2MB, 1.44MB	1.2MB	1.2MB	1.2MB, 1.44MB	1.2MB
Manufacturer	TEAC	Epson	YE Data	YE Data	Mitsumi	TEAC
EXPANSION BUS						
Bus speeds (MHz)	8.25, 11	8, 33	8	8	8.3, 11	8
Slots (8-, 16-, 32-bit)	2, 6, 0	0, 7, 1	2, 5, 1	2, 6, 0	0, 7, 1	1, 6, 1
Slots free in fully configured PC	5	5	5	5	6	4
Ports originate on motherboard	☐	☒	☐	☐	☐	☐
VIDEO						
Display circuitry location	Card	Card	Card	Card	Card	Card
Manufacturer	Everex	ATI	Micro Express	Ahead	GTK	PC Craft
Chip set manufacturer	Everex	ATI	Tseng	Ahead	Western Digital	Paradise
KEYBOARD/MOUSE						
Keyboard manufacturer	NMB	Key Tronic	Maxi-Switch	Maxi-Switch	Monterey	Maxi-Switch
Number of keys, function keys	101, 12	101, 12	102, 12	101, 12	101, 12	101, 12
Keyboard cable length (inches)	106	72	72	62	84.3	64.5
Mouse port	☐	☒	☐	☐	☐	☐
SOFTWARE AVAILABLE						
DOS	4.01	4.01	4.01	3.3, 4.01	4.01 (\$70)	3.3, 4.01 (\$65)
OS/2	1.21 (\$175)	None	1.1 (\$279)	None	None	None
Disk caching software	☒	☒	☐	☐	☐	☐
Expanded memory manager	☒	☒	☐	☐	☒	☐
Other software included	None	Windows 3.0	None	None	QA Plus 4.21, Setsys 2.7	PC Test 1.06
MISCELLANEOUS						
Weitek 3167 support	☒	☒	☒	☒	☒	☐
Physical features:						
Power supply (watts)	200	200	200	200	200	200
Number of device connectors	4	5	4	4	4	6
Keyboard/case lock	Front/front	Front/none	Front/none	Front/none	Front/none	Front/none
Power-on/reset switch	Side/front	Side/front	Front/front	Side/front	Front/front	Front/front
Warranty	1 year	1 year	2 years	15 months	5 years	1 year
Service						
	On-site	Vendor	Vendor	Vendor	90 days on-site; vendor	On-site, dealer or vendor
FCC certification class	B	B	B	B	A	B

☒—Editors' Choice ☒—Yes ☐—No

COMPUTERS

33-MHz 386 PCs

Polywell Computers Inc. Poly 386-33PT	Spear Technology Inc. Spear Ultra 386/33	Tandy Corp. Tandy 4033 LX	Tangent Computer Inc. Tangent 333c	Tri-Star Computers Corp. Tri-Star 386/33	Zeos International Ltd. Zeos 386-33	Zodiac Technologies FiveStar 386/33
1.2MB, 1.44MB TEAC	1.2MB TEAC	1.44MB Varies	1.2MB TEAC	1.2MB, 1.44MB Varies	1.2MB, 1.44MB TEAC	1.2MB, 1.44MB TEAC
8 2, 6, 0 5 □	8 1, 6, 1 5 □	8 0, 6, 1 5 ■	8.25, 11, 16.5 2, 6, 0 5 □	8 1, 6, 1 5 □	8 0, 6, 2 5 □	8 1, 6, 1 5 □
Card Diamond Tseng	Card Everex Everex	Card Tandy Paradise	Card Orchid Tseng	Card STB STB	Card Diamond Tseng	Card STB STB
Chicony 101, 12 67.3 □	Key Tronic 101, 12 76 □	Tandy 101, 12 84 ■	Key Tronic 101, 12 84 □	Nan Tan 101, 12 84 □	Zeos 101, 12 84 □	Focus 101, 12 84 □
3.3, 4.01 1.2 (\$275) □ □ None	3.3, 4.01 1.21 (\$345) □ ■ None	4.01 (\$140) None □ ■ None	4.01 (\$88) 1.2 (\$375) □ □ SCO Unix, SCO Xenix, 386 Multiware	4.01 None □ □ None	3.0, 4.01 None ■ ■ None	4.01 None □ □ Lotus Works
■	■	■	■	■	■	■
250 4 Front/back Front/front 2 years motherboard and graphics, 1 year other parts, 5 years labor Vendor A	200 5 Front/none Side/front 1 year Vendor B	200 4 None/front Front/front 1 year Dealer B	220 5 Front/none Side/front 1 year Vendor, backup on-site A	220 4 Front/none Front/front 1 year Vendor, backup on-site A	250 4 Front/none Front/front 1 year system, 5 years keyboard Vendor B	200 4 Front/none Side/front 1 year Vendor, backup on-site A

ENDS



THE ONLY EXECUTIVE TOOLS MORE COLORFUL THAN THE GSX-140.



The GSX-140 is the ultimate executive business tool for office and home. PC Magazine has awarded it their Editor's Choice for best 24-wire printer.

Like its wide carriage cousin the new GSX-145, the print quality rivals that of any printer in its class and its six resident fonts give you more flexibility to design your output.

And, like all our new printers, it's equipped with our exclusive Color On Command™ feature which gives you the capability of installing dynamic color to make your spread sheets easier to read, your graphics easier to understand, and your presentations simply brilliant.

Speaking of ease of use, it doesn't take a MIS manager to operate the GSX-140 printer. That's because the Command-Vue™ control panel prompts you with plain English directions on its LCD panel. The "Quick" menu gives you instant access to the printer settings most

often changed. It remembers your four favorite software programs and sets them up just the way you like them, every time you use them.

Blending 192 cps, logic seeking, bidirectional printing and high speed paper feed, the GSX-140's high throughput design quietly cranks out page after page far faster than any of the competition.

What more could a busy executive ask for from a printer? How about peace of mind in the form of a 24-month parts and labor warranty.

Once you've tried the new GSX-140, it'll be easy to see how it makes your reports brighter and life easier. For the dealer near you, just call 1-800-441-2345, ext. 34 in Calif., 1-800-556-1234 ext. 34 outside Calif.



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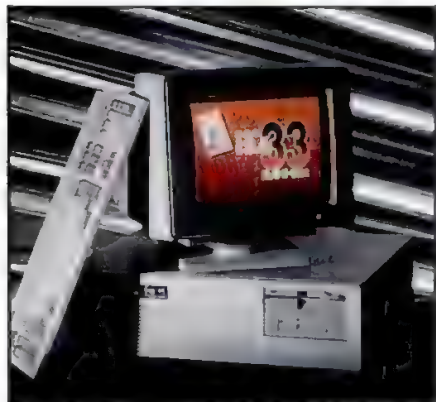
CITIZEN

CIRCLE 318 ON READER SERVICE CARD

and an Intel discrete logic cache controller. The unit's Phoenix BIOS supports video and system BIOS shadowing, both of which can be disabled in setup. The direct-mapped cache is fixed at 64K and uses 25-nanosecond static RAM chips. The motherboard will take either an Intel 80387 33-MHz math coprocessor or a Weitek 3167 unit, but not both.

The system can address a whopping 40MB of 32-bit memory. That amount is divided among the motherboard (which can take 8MB, using 80-ns. 1MB SIMMs) and two 32-bit memory expansion boards (which can hold 16MB each). When not used for memory expansion, the slots for those boards can accept 16-bit cards. Of the machine's other slots, one is an 8-bit and five are 16-bit. I/O circuitry is built into the motherboard, so our evaluation unit had six free slots after a video card and drive controller were installed.

If you've ever owned an IBM AT or lookalike, you'll find that the Data 386-33's case, with its power switch on the right side, looks familiar. A reset switch and keyboard lock are on the case's front panel. The machine has neither a turbo switch nor a case lock. Like the original AT, the Data 386-33 can hold five half-height drives, though the Dataworld machine lets three use removable media while the AT supported only two removable media devices. The standard power supply is



Dataworld Data 386-33, \$4,185.

a Sun Moon Star 200-watt unit with four device connectors.

In our tests, the Data 386-33 did well overall. Its scores on our processor tests were on the low side of average, but still perfectly acceptable. On our Conventional Memory test, the Dataworld machine tied several others for second place. Video

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COMPUTERS

33-MHz 386 PCs

scores were average or above average. And the Micropolis drive's measured time on the BIOS Disk Seek test beat its 16-millisecond rating.

Dataworld sells some machines through VARs and dealers, but most are purchased through mail order. Like many of the other top mail-order dealers, Dataworld has a superb mixture of service

motherboard, reducing clutter and leaving more room for expansion in its midsize 6-by-16-by-16-inch case than you'll find in many full-size desktop models.

In its \$3,349 basic configuration, the neatly styled System 333D comes with 1MB of RAM, a 64K processor RAM cache, a 40MB IDE hard disk, a 1.2MB or 1.44MB floppy disk drive, a VGA monochrome monitor, one parallel and two serial ports, and a 101-key keyboard. Equipped to conform to our standard configuration, the machine costs \$4,918, with 4MB of RAM, a 64K cache, a 15-millisecond 190MB Maxtor hard disk, Super VGA video and color monitor, DOS 4.01, and the same remaining components. Our tested unit was more fully equipped, with one 1.2MB Mitsubishi and one 1.44MB Sony floppy disk drive, both of which were stacked atop a 150MB Wangtek tape backup system. A small control panel on the center of the system unit houses Dell's Smartvu status display as well as the power and reset buttons.

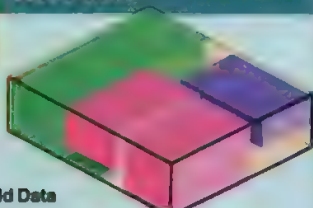
VLSI builds the chip set for the machine, and Phoenix supplies the BIOS, so Dell has matters well covered here. The slot-saving motherboard allows shadowing for both the video and system BIOS.

For mass storage, Dell offers you a variety of IDE and ESDI drives for the System 333D, ranging in price from \$399 to \$999 for the IDE models and from \$1,799 to \$2,799 for the ESDI units. The 190MB Maxtor hard disk in our evaluation unit was a vertically mounted 3.5-inch model.

In addition to the two floppy disk drives and the tape drive that came with our unit, there was an additional 3.5-inch vertical



FACT FILE



Dataworld Data 386-33
 Dataworld Inc., 3733 San Gabriel River Pkwy., Pico Rivera, CA 90660-1404; (800) 736-3282, (213) 695-3777.
List Price: With 1MB RAM, 1.2MB floppy disk drive, Hercules-compatible video adapter, monochrome monitor, one parallel and two serial ports, \$1,980; with 4MB RAM, 161MB hard disk, 1MB Orchid ProDesigner II Super VGA interlaced video adapter, Super VGA interlaced color monitor, DOS 4.01, \$4,185.
In Short: The Data 386-33 is a desktop unit that can handle 40MB of RAM and offers six empty slots. Average performance coupled with a good price and excellent service and support policies justify clearing space on your desk for this computer.

CIRCLE 625 ON READER SERVICE CARD

and support policies. Its standard warranty is for one year and covers parts and labor. On-site service for the first year through TRW is also standard. Other policies include six-day-per-week toll-free technical support and a 30-day money-back guarantee.

Good performance, good prices, and great service. Isn't that what you're looking for? A smaller case or more room for drive expansion would be nice, but the Data 386-33 is already a very good deal.

DELL COMPUTER CORP.

Dell System 333D

by Fredric Burke

Dell Computer Corp. wasn't the first vendor out of the gate with a 33-MHz 386 machine, but its Dell System 333D was worth the wait. The System 333D separates itself from the competition by placing critical components—I/O and drive controllers and the Super VGA chip set—on the



Dell System 333D, \$4,918.

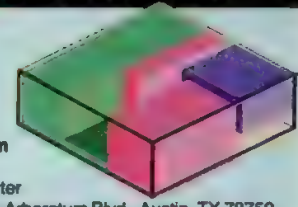
Dell also employs an Austek cache controller and a fixed 64K cache of 25-nanosecond static RAM. The motherboard will also support either an Intel 80387 or Weitek 3167 math coprocessor.

The System 333D comes fairly well-endowed with RAM, although other manufacturers' machines can top the 16MB of interleaved page-mode RAM that the System 333D will support. The 4MB of memory in our evaluation unit was packaged in 1MB 80-ns. SIMMs; to upgrade system memory to 16MB you'll have to use 4MB SIMMs.



FACT FILE

EDITOR'S CHOICE



Dell System 333D
 Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; (800) 426-5150.
List Price: With 1MB RAM, 64K processor RAM cache, 40MB hard disk, 1.44MB or 1.2MB floppy disk drive, monochrome VGA display subsystem, one parallel and two serial ports, \$3,349; with 4MB RAM, 190MB hard disk and 150MB tape backup, 1.2MB or 1.44MB floppy disk drive, Super VGA display subsystem, DOS 4.01, \$4,918.
In Short: The Dell System 333D distinguishes itself from the pack by placing critical components—I/O and drive controllers and the Super VGA chip set—on the motherboard, leaving more room for expansion in its midsize case than you'll find in many full-sized desktop models. It offers extremely fast video performance.

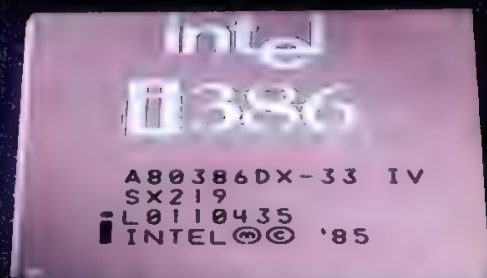
CIRCLE 626 ON READER SERVICE CARD

drive bay next to the hard disk. Dell also makes provision for an optional \$379 internal 40MB tape drive; the piggyback drive attaches to the back of one of the 3.5-inch bays, with the disadvantage of masking two slots.

As Dell does with the I/O and drive controllers, the company also mounts its video on the motherboard, leaving one 8-bit and five 16-bit slots free for add-in boards. Western Digital makes the Super VGA chip set, and NEC the 14-inch Multi-Sync 3D monitor. Astec manufactures the System 333D's just-adequate 177-watt power supply, and Alps makes the 101-key keyboard.

In our tests, the System 333D was an average performer—with one notable exception. With its video circuitry built directly onto the motherboard, this system proved to be one of the leaders of the group in our video tests.

Dell's service and support policies for the System 333D are standard: one-year



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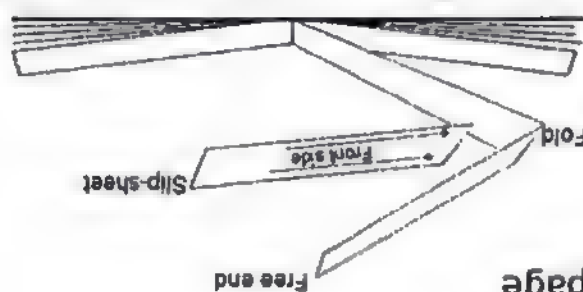
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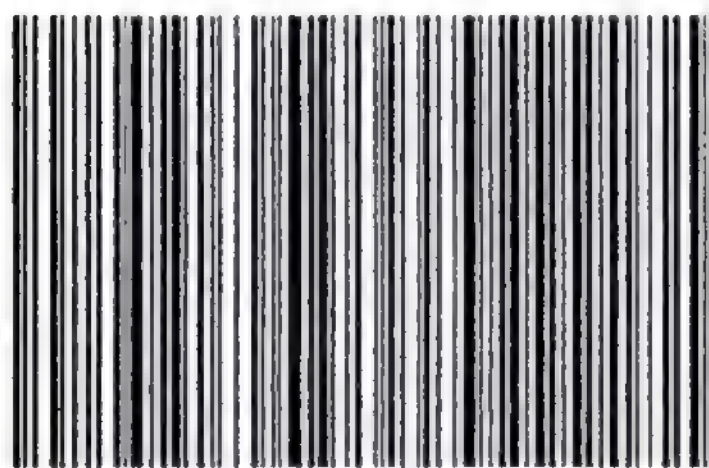
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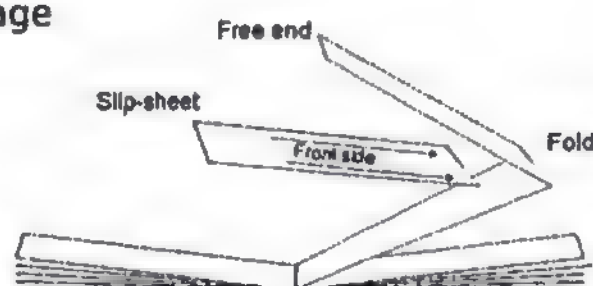


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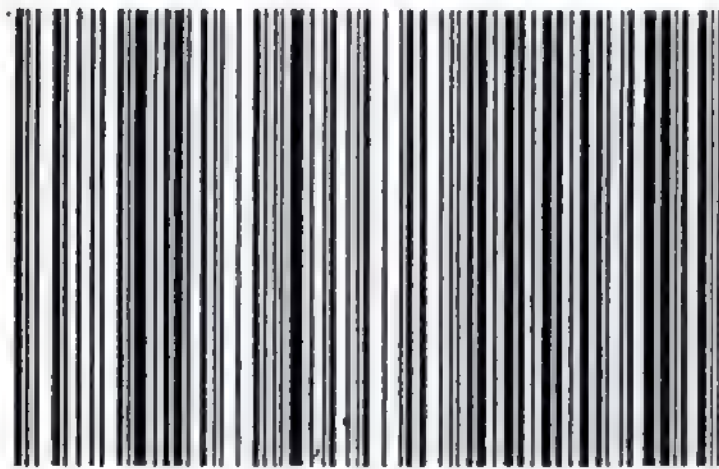
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Back

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Sim the F

10 Good Reasons To Buy From ZEOS®

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In one recent '386 review, *PC Magazine* awarded ZEOS Editors Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

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Reason #3

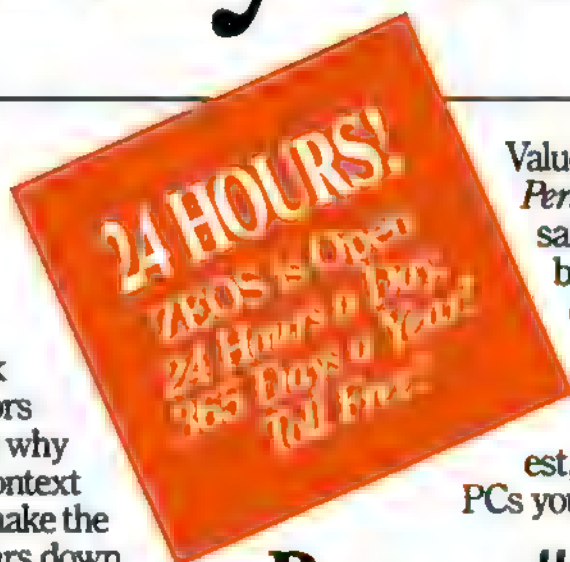
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Bus. Phone (_____) _____ Monthly Gross Salary \$ _____

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COMPUTERS

33-MHz 386 PCs

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With its System 333D, Dell has come up with a technically sophisticated, well-supported, reasonably priced powerhouse.

DESTINY COMPUTERS

Destiny 386 1000

by John R. Quain

With 33-MHz 386 PCs now at or below the \$4,000 mark, you may start to think that \$4,671 is too much to spend on a seemingly nondescript clone. One offsetting value in the case of the Destiny 386 1000 is that you can purchase the machine through a dealer and still have it specially configured by the manufacturer at your behest. On the other hand, trapped as the 386 1000 is in a small 6.5- by 18.1- by 16.8-inch case, the power user may not be able to get everything he or she wants inside.

Compared with the last Destiny 33-MHz 386 machine we reviewed last February ("Speed to Burn: 22 of the Fastest 386s," *PC Magazine*, February 13, 1990), the 386 1000 is not as jammed with high-end brand-name options. Our evaluation unit came with 4MB of RAM, a 64K cache of 25-nanosecond static RAM, an 18-millisecond 150MB Maxtor hard disk, a 1.2MB 5.25-inch Chinon floppy disk



Destiny 386 1000, \$4,671.

drive, a BTC Super VGA card, a 14-inch ADI Super VGA monitor, one parallel and one serial port, and a 102-key BTC keyboard. If you don't want all this, you can consider the 386 1000 in its basic \$2,199 configuration, which includes 1MB of RAM, the same cache, ports, keyboard, and floppy disk drive, and a monochrome

monitor and adapter.

The familiar Maxtor ESDI hard disk performed quite well in our tests, beating its own rating and placing solidly in the top third of the hard disk rankings—a bonus for those who have to search through deep databases. On the other hand, the 16-bit BTC Super VGA ProDesigner II card, which uses the Paradise chip set, turned in average results, falling in the middle of the pack. On our processor tests, the 386 1000 came in on the slow side of average.

The 386 1000's Award BIOS supports video and system BIOS shadowing. If memory conflicts become a concern, you can disable the shadowing through the BIOS setup. You can also use the BIOS setup to change wait states from zero-write to three-write. The slimmed-down seven-eighths-size box comes with a system board manual for the OPTI chip set, pamphlets covering the NCL integrated ESDI controller, and supplementary material on the Award BIOS—but there's no user's manual. In other words, this is not a machine you should turn over to a novice.

Memory on the TMC motherboard can be brought up to a total of 8MB of SIMMs (for \$856), with an additional 8MB available on a proprietary add-in board (pricing had not been determined). For DOS 4.01, you pay an additional \$99.

The system board handles the standard complement of eight expansion slots: one 8-bit slot, six 16-bit slots, and a proprietary 16/32-bit slot. The disk controller card was situated such that the connectors to the hard and floppy disk drives blocked the slot next to it, but we could move the card to the last slot to solve the problem. Still, you can't use a full-length card in the last slot, because the vertical bracket for the 3.5-inch drive sits over the motherboard's expansion slots. If you try to cram in a deeper 5.25-inch drive here, it reduces the length of the slot even more. And if you want to add another serial port, you'll lose another slot.

The source of this real-estate problem is the odd placement of the 386 1000's power supply and drive bay brackets, which slice through the chassis rather than being relegated to the far right. It is an unhappy compromise: The case is not small enough to let the unit qualify as a true small-footprint model, yet you lose the expandability of a full-size box.

The additional elements of the system didn't add any sparkles either. The sup-

plied 14-inch ADI Super VGA color monitor was adequate, but nothing that would dazzle you as you played *Flight Simulator*. There isn't much response in the small BTC keyboard, and the position of the backslash key (at the bottom right of the

FACT FILE



Destiny 386 1000
 Destiny Computers, 745 Whitney St., San Leandro, CA 94577; (800) 366-4272
List Price: With 1MB RAM, 64K processor RAM cache, 1 2MB floppy disk drive, CGA monochrome display subsystem, one parallel and one serial port, \$2,199; with 4MB RAM, 150MB hard disk, Super VGA color display subsystem, DOS 4.01, \$4,671.
In Short: The Destiny 386 1000 is a small (but not quite small-footprint) 33-MHz machine that you can purchase from a dealer and still have the manufacturer specially configure. Its case size and the odd placement of its power supply and drive bay brackets limit its expandability.

CIRCLE 627 ON READER SERVICE CARD

main keyboard rather than in the customary top right spot) takes a bit of getting used to.

There are other minor irritations with the 386 1000: For instance, we tore off one of the rubber feet on the CPU by sliding it around on the desktop. Some may find that Destiny's service is also a bit short-lived. Yes, you get the standard one-year protection for parts and labor, but you'll receive only 90 days of on-site service from TRW. After that, you have to return your system to the dealer or pay for one-way shipping back to Destiny. In the end, the Destiny 386 1000 is a Class A office-only machine that can be delivered according to your initial specifications. Future expansion, however, looks limited.

DIGITAL SCIENTIFIC RESEARCH CORP.

DSR/Tiger 386

by Bruce Brown

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On a desk, with its optional 30-sheet paper feeder, it's an ideal personal printer. As a single-sheet portable with its optional rechargeable battery pack, it weighs a remarkable 4.6 pounds and prints on a variety of paper. Moreover, the BJ-10e emulates the IBM® Proprinter™ X24E, so you can use a wide range of applications software.

How fast is it? It prints 83 characters per second and won't slow down when printing in bold or various type sizes. It even handles complicated graphics such as the scanned-in image printed here. And, it's so quiet it can be used in the middle of the night with someone asleep just a few feet away.

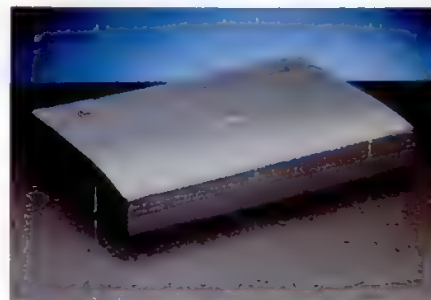
Plus you never have to worry about maintenance because it uses an economical pop-in BJ cartridge, containing the print head and ink supply, which prints approximately 700,000 characters (HQ mode). But best of all, the BJ-10e works everywhere you could possibly need it, fitting neatly into a briefcase.

The BJ-10e Bubble Jet. What other printers print on a desk, it prints anywhere.

The document displayed in the BJ-10e is actual output using the UltraScript™ pc software BJ-130e™ printer driver.

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BUBBLE JET PRINTER
BJ-10e

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On October 29, 1990,
The Wall Came Down.
Bravo 486 \$3,995.



AST Research
10
Ten Years On
Eighth Edition

There's a new revolution in i486™ computing. The power-packed AST Bravo 486/25. A price/performance breakthrough at only \$3995.

The world is changing. You need more power than ever before. You need the power to run Windows 3.0, desktop publishing, multitasking applications, PC-based CAD and other everyday business applications.

But you shouldn't have to pay a fortune to get it. That's why AST is introducing the high-performance i486 that not only costs thousands less than other i486 systems, it's actually less expensive than many 386™ computers.

Nearly two times faster than a 33 MHz, 386 system, the Bravo 486 is even faster than a Sun® SPARCstation™. And for CAD programs, we've

15.8*
MIPS

Sun
SPARCstation
Series 300

17.84*
MIPS

AST
Bravo
486/25

included support for a Weitek 4167 math coprocessor. This simple addition allows some CAD programs to run up to twice as fast.

And because the Bravo is a full-power machine built on one of the most integrated designs in the industry, you'll be assured of the highest level of quality, reliability and performance. This integration allows you to connect your Bravo 486 to a VGA monitor, a mouse, two printers and a modem — and still have five full 16-bit slots ready for future expansion. Also, Super VGA circuitry, not just ordinary VGA, is built in, right on the motherboard.

Another benefit of integration — the Bravo comes

in a small-size chassis. It actually takes up 25% less space on your desk than a Compaq® Deskpro® 486/25. It's the quickest way we know to move up to a bigger desk.

So join the revolution. Today you need the power the Bravo 486 delivers, and the value only AST can supply. For more information, call us, toll free at 1-800-876-4AST. Or use your modem to connect to our On-Line electronic technical information network at (714) 727-4723.

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COMPUTERS

33-MHz 386 PCs

machines have been reviewed in *PC Magazine*. Now DSR has decided to go after a piece of the retail market. Its first offering, the DSR/Tiger 386, is an ambitious machine that's selling at an appealing price.

Most likely you'll find that the DSR/Tiger 386 is sold with either 2MB (using 256K SIMMs) of RAM or 8MB



DSR/Tiger 386, \$4,109.

(using 1MB SIMMs). Although DSR prefers not to sell its machine with 4MB of RAM, for the sake of comparison the company provided us with a price for a system with this amount of memory—\$3,469, with a 64K processor RAM cache, a 204MB Conner 15-millisecond hard disk, a 1.2MB Epson floppy disk drive, a 512K DSR Super VGA video board based on the Trident chip set, and a 14-inch CTX multiscanning Super VGA monitor. Other components include a Maxi-Switch keyboard with an integrated trackball, one parallel and two serial ports, DOS 4.01, and Windows 3.0. With 2MB of RAM, an 80MB hard disk, and the same remaining components, the DSR/Tiger 386 costs \$2,899.

If those figures look good—and they should—the price of our evaluation unit should look even better. Equipped with 8MB of RAM, an additional 1.44MB floppy disk drive, a 33-MHz Intel 80387 math coprocessor, and the same remaining components, our test machine costs \$4,109—a very good deal, indeed.

The DSR/Tiger comes in an attractive 18.8- by 6.5- by 16-inch minitower case, the front of which is home for the power, turbo, and reset switches and keyboard lock. At first glance, the drive-bay setup looks merely generous for a case this size, with room for three half-height 5.25-inch and three 3.5-inch drives. Closer inspection of the 3.5-inch cage reveals that it can hold two 5.25-inch half-height drives ver-

tically or, with careful placement, five 1-inch-high 3.5-inch-format drives. IDE circuitry is built into the machine, providing support for two hard disks and four floppy disk drives. If you plan to pack your system with drives, you might want to upgrade the 200-watt Astec power supply, which has only four device connectors.

DSR's entry uses the Texas Instruments Tiger 386 chip set, hence the system's name. DSR makes the motherboard, and uses a Quadtel BIOS (which supports both video and system BIOS shadowing) and an Intel 82385 RAM cache controller. The fixed 64K static RAM cache in our evaluation unit used 25-nanosecond chips. The board can work with two math coprocessors installed, although you'll find only a socket for one.

When it comes to system memory, the DSR/Tiger pulls out all the stops to support up to 144MB of RAM. Using 4MB SIMMs, the motherboard has room for 32MB of 32-bit memory (the SIMMs in our evaluation unit were rated at 70 ns.); it can also accommodate 16MB of 16-bit

DSR is taking a risk by releasing an innovative machine as its first offering; it might take a few iterations before everything is perfect.

RAM. You can insert an additional 96MB of 32-bit RAM with a proprietary memory expansion card, the price of which has not yet been determined. If you don't use the 32-bit slot for the memory board, it can take an 8-bit card. Other slots include six 16-bit slots and one 8-bit slot.

Overall, the Tiger 386's performance is about average, with midrange scores on all PC Magazine Labs' benchmark tests other than the large-record DOS File Access test and Video Direct To Screen test, which both fell near the bottom of the pack.

DSR is just starting to distribute its machines, and for the time being sells them only directly. The FCC Class A-certified



FACT FILE

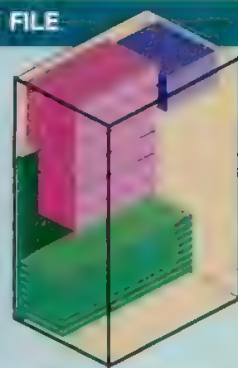
DSR/Tiger 386

Digital Scientific Research Corp., 8025 Deering Ave., Kanoga Park, CA 91304; (800) 473-1991, (818) 888-8880.

List Price: With 2MB RAM, 80MB hard disk, 1.2MB floppy disk drive, 512K Super VGA video adapter, multiscanning Super VGA color monitor, one parallel and two serial ports, DOS 4.01, \$2,899; with 4MB RAM, 204MB hard disk, \$3,469; with 8MB RAM, 1.2MB and 1.44MB floppy disk drives, math coprocessor, \$4,109.

In Short: The DSR/Tiger 386 pulls out all the stops, supporting up to 144MB of RAM and accommodating more drives than most machines. Its very low price, average performance, and passable service and support policies make this tower unit an interesting machine to consider.

CIRCLE 628 ON READER SERVICE CARD



DSR/Tiger 386 is backed by a one-year parts-and-labor warranty. Service is performed at the company's California facility (DSR is negotiating with two companies to provide on-site service at an extra cost). If you have a defective part or system, DSR will cover the shipping costs both ways for warranty service for the first month you own the machine. After the first 30 days, DSR will pick up the tab for one-way shipping.

Buying a computer from a new company is chancy, but DSR has manufactured components for some time. The company is going out on a limb by releasing an innovative machine as its first offering, and it might take a few iterations of the motherboard before everything is perfect. Our test machine was solid, however, and its low price is worthy of attention.

DTK COMPUTER INC.

DTK Keen-3304

by Bruce Brown

Most of DTK Computer's systems are sold under private labels through distributors, but the company sells some machines under its own name through dealers. Unless you can get a very good discount from a dealer, there is nothing special about the DTK Keen-3304 to recommend.

In its most stripped-down configura-

tion, the Keen-3304 costs \$2,299. You don't get very much for that price—a motherboard, a 64K processor RAM cache, a tower case, and a power supply. Our \$6,105 tested unit, which was a mid-range performer on PC Magazine Labs' benchmark tests, had 4MB of RAM, 64K of processor RAM cache, a 15-millisecond 158MB Maxtor ESDI hard disk, an integrated Adaptec ESDI controller, 1.2MB and 1.44MB Mitsumi floppy disk drives, an ATI Super VGA Wonder video card and a NEC MultiSync 2A monitor, one parallel and two serial ports, a 101-key Key Tronic keyboard, and DOS 4.01.

DTK manufactures its motherboard and uses its own BIOS and integrated 386 chip set and RAM cache controller circuitry. The direct map write-back cache consists of 64K of 25-nanosecond static RAM. The cache is expandable to 256K. The motherboard supports both video and system BIOS shadowing, which you can set or disable through the CMOS setup



DTK Keen-3304, \$6,105.

program. You can also issue a system password during setup. The system will support an Intel 80387 math coprocessor running at 33 MHz or a Weitek 3167, but not both. Its bus speed can be set to operate at either 6 or 8 MHz.

The Keen-3304's motherboard can accommodate up to 8MB of RAM. You can add another 8MB with an optional proprietary memory expansion card that fits in a single 32-bit slot. The installed memory in our evaluation unit was rated at 70 ns.

When it's not used for adding memory, the 32-bit slot can handle 8-bit cards. Of the remaining slots, six are 16-bit and one is 8-bit.

Inside the Keen-3304's 22- by 7- by 19.8-inch tower-style case are some fairly rough-edged support pieces—not a great

COMPUTERS

33-MHz 386 PCs

FACT FILE

DTK Keen-3304
DTK Computer Inc.,
15711 E. Valley Blvd.,
City of Industry, CA
91744; (818) 333-
7533.
List Price: With 4MB
RAM, 64K RAM
cache, 158MB hard
disk, 1.2MB and
1.44MB floppy drive,
Super VGA color
display subsystem,
one parallel and two
serial ports, DOS 4.01, \$6,105.
In Short: DTK's tower-style Keen-3304 is an
average performer at a higher-than-average
price. It offers plenty of expansion room but is
backed by minimal manufacturer support; the
dealers are responsible for service. Look for big
discounts—or look elsewhere.

CIRCLE 629 ON READER SERVICE CARD

sign of quality. The case will hold seven half-height drives, with three able to use removable storage media. The power supply is a DTK 200-watt model with five power leads. All controls, including the power, reset, and turbo switches and the case lock, are on the front of the case.

The standard one-year warranty on DTK machines covers parts and labor. Service is performed by dealers; contractual on-site service from DTK is not an option. DTK's dealers may bend over backwards to serve their customers. But with so little manufacturer support and a somewhat high list price, the DTK Keen-3304 doesn't seem worth the investment—unless, of course, you can get a discount of 35 to 40 percent.

DYNA MICRO INC.

Dyna Work Master 386 33 Plus

by Fredric Burke

Dyna Micro's Work Master 386 33 Plus replaces the Dyna 33 Series as the company's performance leader. The result: an intelligently updated but expensive machine that offers average 33-MHz performance and expansion options.

Our \$7,995 evaluation unit came equipped with 4MB of RAM, a 64K processor RAM cache, a 182MB CPC hard

disk, one 1.44MB and two 1.2MB TEAC floppy disk drives, an Orchid ProDesigner II Super VGA card and a NEC MultiSync 4D monitor, one parallel and two serial ports, a game port, and an MTEK 101-key keyboard—a standard setup for a power user but hardly a bargain price. With 4MB of RAM, one 1.2MB and one 1.44MB floppy disk drive, and a color VGA display system, the basic configuration package costs \$6,350.

The most notable change to the FCC Class A-rated Work Master is its new AMI motherboard, which replaces the OEM unit employed in the old 33 Series. It will run the processor at either 8 MHz or 33 MHz and the I/O bus at a safe, sedate 8 MHz. The motherboard uses a Chips and Technologies 386 chip set as well as discrete logic. AMI provides the BIOS, which supports both video and system BIOS shadowing. The motherboard will handle socketed Intel 80387 and Weitek 3167 math coprocessors simultaneously.



Dyna Work Master 386 33 Plus, \$7,995.

Using a proprietary cache controller, the Work Master offers a fixed 64K cache of 20-nanosecond static RAM. The motherboard currently handles 8MB of 70-ns. RAM in 1MB SIMMs, but Dyna Micro has recently finished testing 4MB SIMMs and will soon make them available to users. This will push installable motherboard RAM to 32MB, making Dyna Micro's \$250 32-bit 8MB memory card seem more of an option than it otherwise might.

The Work Master's standard tower chassis measures 25 by 9.5 by 18.5 inches. Inside the sturdy chassis reside six half-height drive bays, an acceptable number for a tower unit, and a 25-watt power supply from PC Power and Cooling. The full-



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-Computer Monthly, PC Brand 286/16 Product Review

286/16MHz and 286/20MHz ISA Systems

286/16 and 20 Base Systems

Customize with the Video and Hard Drive options of your choice

- True 80286-16/20 w/ Zero Wait States
- Landmark Speed 20.6MHz (286/16), 26.7MHz (286/20)
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- 512K RAM (expandable to 8MB)
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- 101 Key Click/Tactile Keyboard
- 1 Parallel and 2 Serial Ports

16MHz **\$549**

20MHz **\$649**

286/16 and 20 Mono Packages

This preconfigured system includes all the features of our base system with:

- 512K RAM (expandable to 8MB)
- 40MB/25Ms Hard Drive
- 12" Mono Graphics Monitor
- Hercules Compatible Mono Graphics Card
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20MHz **\$1,099**

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Standard Features

- 80286 16, 80286-20 operating at 16MHz or 20MHz with Zero Wait States
- 512K RAM expandable to 8MB on the System Board
- 1:1 interleaved Hard/ Floppy Drive Controller, with 1MB second disk transfer rate
- 1 Parallel and 2 Serial Ports
- High capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support

Standard Features Cont.

- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM, and PCNET compatibility
- Built in System Board LIM 4.0EMS hardware
- 7 Slot Motherboard Design (5 16bit & 2 8bit)
- Medium Footprint Desktop Case with 6 Disk Drive Bays

Case Options

- Slim Line
- Mini Tower
- Full Size Tower

Hard Drive Options

- 40MB/25MS
- 89MB/19MS
- 125MB/19MS
- 170MB/15MS
- 200MB/16MS
- 320MB/16MS
- 640MB/16MS

Video Options

- Mono Graphics
- VGA Mono
- VGA Color (640 x 480)
- Super VGA Color (1024x768)

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"The PC Brand 386/SX-16 performed at least as well as the far costlier Compaq... We simply began marveling at what is surely the best bargain in personal computing."

-Computer Buyer's Guide, 386SX-16 Product Review

386/SX-16 Non Cache and 386/SX-20 Cache ISA Systems

386/SX-16 Non Cache and 386/SX-20 Cache Base Systems

Customize with the Video and Hard Drive options of your choice

- True 386™ SX™ Processor operating at 16MHz or 20 MHz with Zero Wait States
- Landmark Speed 18.3MHz (386/SX-16 Non-Cache), 28.9MHz (386/SX-20 Cache)
- Norton SI 18.7 (386/SX-16), 23.4 (386/SX-20)
- 512K RAM (expandable to 8MB)
- 16K CPU RAM Cache (SX-20 only)
- 1.2 MB or 1.44 MB Floppy Drive
- 101 Key Click/Tactile Keyboard
- 1 Parallel and 2 Serial Ports

SX-16 \$799

SX-20 \$899

386/SX-16 Non Cache and 386/SX-20 Cache Super VGA Packages

This preconfigured package includes all the features of our base system with:

- 2MB RAM (expandable to 8MB)
- 40 MB/25Ms Hard Drive
- 14" Super VGA (1024 x 768 Resolution) Color Monitor
- 16 Bit High Performance VGA Card with 512K Video RAM
- Dual 1.2 MB and 1.44 MB Floppy Drives
- High Resolution Mouse

SX-16 \$1,947

SX-20 \$2,047

All Systems also Include: Free On-Site Service by TRW¹, Our Unique 5 Year Warranty, Unlimited Toll-Free Service and Support, Our 30-Day No Risk Money Back Guarantee and Volume Purchase Discounts.

PC Brand Will Customize Any System to Your Exact Specifications, with name brand products from vendors like NEC, Paradise, ATI, Novell and many others, at outstanding prices. Call for quotation.

Standard Features

- True 386™ SX™ Processor operating at 16 MHz or 20 MHz with Zero Wait States
- 512K RAM expandable to 8MB on System Board
- 16K CPU RAM Cache (SX-20 only) with Posted Write and Writeback Logic
- 1:1 Interleaved Hard/Floppy Drive Controller with 1MB/second disk transfer rate
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery

Standard Features Cont.

- 1 Parallel and 2 Serial Ports
- 387™ SX™ CoProcessor Support
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM, and PCNET compatibility
- 8 Slot Motherboard Design (5 16bit and 3 8bit)
- Medium Footprint Desktop Case with 6 Disk Drive Bays

Case Options

- Slim Line
- Mini Tower
- Full Size Tower

Hard Drive Options

- 40MB/25MS
- 89MB/19MS
- 125MB/19MS
- 170MB/15MS
- 200MB/16MS
- 320MB/16MS
- 640MB/16MS

Video Options

- Mono Graphics
- VGA Mono
- VGA Color (640x480)
- Super VGA Color (1024x768)

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-InfoWorld, 386/33 Product Review

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Customize with the Video and Hard Drive options of your choice

- True 25MHz or 33MHz Intel 80386 CPU operating with Zero Wait States
- Landmark Speed 43.5MHz (386/25Cache), 58.7MHz (386/33Cache)
- Norton SI 31.6 (386/25Cache), 45.9 (386/33Cache)
- 1MB RAM (expandable to 16MB)
- 1.2MB or 1.44MB Floppy Drive
- 101 Key Click/Tactile Keyboard
- 1 Parallel and 2 Serial Ports

25MHz **\$1,399**

33MHz **\$1,599**

386/25 and 33 Cache Super VGA Packages

This preconfigured package includes all the features of our base system with:

- 4MB RAM (expandable to 16MB)
- 125MB/19MS Hard Drive
- 14" Super VGA (1024 x 768 Resolution) Color Monitor
- 16 Bit High Performance VGA Card with 512K Video RAM
- Dual 1.2MB and 1.44MB Floppy Drives
- High Resolution Mouse

25MHz **\$2,974**

33MHz **\$3,174**

All Systems also include: Free On-Site Service by TRW¹, Our Unique 5 Year Warranty, Unlimited Toll-Free Service and Support, Our 60-Day* No Risk Money Back Guarantee and Volume Purchase Discounts.

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Standard Features

- True 25MHz or 33MHz Intel 80386 CPU operating at Zero Wait States
- Direct Map Cache Processor with 64K static RAM standard expandable to 64K
- 1MB RAM expandable to 16MB on the System Board
- 1:1 Interleaving Hard/Floppy Drive controller, with 1MB/second disk transfer rate
- 1 Parallel and 2 Serial Ports
- 387[™] or Weitek Coprocessor Support

Standard Features Cont.

- High capacity 200 watt System Power Supply
- RealTime Clock/Calendar with 5 Year Battery
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM and PCNET compatibility
- 8 slot Motherboard design
- Medium Footprint Desktop Case with 6 Disk Drive Bays

Case Options

- Slim Line
- Mini Tower
- Full Size Tower

Hard Drive Options

- 40MB/25MS
- 89MB/19MS
- 125MB/19MS
- 170MB/15MS
- 200MB/16MS
- 320MB/16MS
- 640MB/16MS

Video Options

- Mono Graphics
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- VGA Color (640x480)
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*60-day return for 386/33 InfoWorld Recommended System.

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-PC Magazine, 386/25 product review

386/25MHz ISA Systems

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Customize with the Video and Hard Drive options of your choice

- True 25MHz Intel 80386 operating with Zero Wait States
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- Norton SI 28.2
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- 1.2MB or 1.44MB Floppy Drive
- 101 Key Click/Tactile Keyboard
- 1 Parallel and 2 Serial Ports

25MHz **\$1,149**

386/25 Super VGA Package

This preconfigured package includes all the features of our base system with:

- 4MB Ram (expandable to 16MB)
- 89MB/19MS Hard Drive
- 14" Super VGA (1024 x 768 Resolution) Color Monitor
- 16 Bit High Performance VGA Card with 512K Video RAM
- Dual 1.2MB and 1.44 Floppy Drives
- High Resolution Mouse

25MHz **\$2,553**

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Standard Features

- True 25MHz Intel 80386 CPU Operating with Zero Wait States
- 1MB RAM expandable to 16MB on the System Board
- 1:1 Interleaving Hard / Floppy Drive Controller, w/ 1MB/second disk transfer rate
- 1 parallel and 2 serial ports
- High Capacity 200Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 387⁺ or Witek Co-Processor Support

Standard Features Cont.

- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM and PCNET compatibility
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium Foot Print Desk Top Case with 6 Disk Drive Bays

Case Options

- Slim Line
- Mini Tower
- Full Size Tower

Hard Drive Options

- 40MB/25MS
- 89MB/19MS
- 125MB/19MS
- 170MB/15MS
- 200MB/16MS
- 320MB/16MS
- 640MB/16MS

Video Options

- Mono Graphics
- VGA Mono
- VGA Color (640x480)
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-Personal Computing, 10 Best Mail Order Companies

486/25MHz and 486/33MHz Cached ISA Systems

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- True 25MHz or 33MHz Intel 80486 CPU operating at Zero Wait States
- Landmark speed 114.1MHz (486/25), 150MHz (486/33)
- Norton SI 41.5 (486/25) 51.5 (486/33)
- 1MB RAM (expandable to 32MB)
- 1.2MB or 1.44MB Floppy Drive
- 101 Key Click/Tactile Keyboard
- 1 Parallel and 2 Serial Ports

25MHz **\$2,499**

33MHz **\$3,499**

486/25 and 33 Super VGA Packages

This preconfigured package includes all the features of our base system plus:

- 4MB RAM (expandable to 32MB)
- 125MB/19Ms Hard Drive
- 14" Super VGA (1024 x 768 Resolution) Color Monitor
- 16 Bit High Performance VGA Card with 512K Video RAM
- Dual 1.2MB and 1.44MB Floppy Drives
- High Resolution Mouse

25MHz **\$4,074**

33MHz **\$5,074**

All Systems also Include: Free On-Site Service by TRW*, Our Unique 5 Year Warranty, Unlimited Toll-Free Service and Support, Our 30-Day No Risk Money Back Guarantee and Volume Purchase Discounts.

PC Brand Will Customize Any System to Your Exact Specifications, with name brand products from vendors like NEC, Paradise, ATI, Novell and many others, at outstanding prices. Call for quotation.

Standard Features

- True 25MHz or 33MHz Intel 80486 CPU operating at Zero Wait States
- 1MB RAM expandable to 32MB
- Built-in 8K 4-Way Set Associative Cache
- Built-in Intel 487 Numeric Coprocessor
- Optional 128K or 256K auxillary CPU Cache Card
- Optional Weitek Card
- 1:1 Interleaved Hard/Floppy Drive Controller with 1MB/second disk transfer rates
- 1 Parallel and 2 serial Ports
- High capacity 200 watt System Power Supply

Standard Features Cont.

- Real Time Clock /Calander with 5-year Battery
- 7 Slot Motherboard Design with one 32bit proprietary Zero Wait State Slot
- Industry Standard BIOS with MS/DOS, OS/2, XENIX, UNIX, NOVELL, and 3COM and PCNET compatibility
- Medium footprint desktop case with 6 disk drive bays

Case Options

- Slim Line
- Mini Tower
- Full Size Tower

Hard Drive Options

- 40MB/25MS
- 89MB/19MS
- 125MB/19MS
- 170MB/15MS
- 200MB/16MS
- 320MB/16MS
- 640MB/16MS

Video Options

- Mono Graphics
- VGA Mono
- Color VGA (640 x 480)
- Super VGA Color (1024 x 768)

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Rock Solid Quality

At PC Brand our mission is simple: to provide you with computer systems to your exact specifications; constructed with only top quality components from the industry's leading manufacturers; at an outstanding price. The Best in the Business.

PC Magazine said it best in a recent review: "...PC Brand machines are an efficient combination of in-house engineering and top-notch off the shelf parts..."

Infoworld obviously agrees awarding their highest honor 'Recommended Product' with its quality seal of approval, to our 386 33 Cache Product.

Rock Solid Warranty.

The Best way we can stand behind our pledge to quality is to support it with the longest standing warranty in the Business. 5 Years.

Rock Solid Support.

The need for support installing specialized software, add-on peripherals, LAN's and the like is not a matter of *IF* you need it, but *WHEN*. Our job is to be there, when you need us, just a telephone call away to pitch-in and get your problem solved. That is our challenge and our commitment backed by the skills and service of some of the best technicians in the business, at your service through our unlimited Toll-Free Techline program. The Best in the Business.

Rock Solid Service.

In addition to our unlimited Toll-Free Techline, If your system requires a repair there's no need to send it back or carry it in, we'll come out to your site and fix it Free-of-Charge for any 386/SX, DX or 486 Computer

Rock Bottom Price.

With PC Brand you deal direct. No middleman, no dealers, no distributors; no 'partners in profit' to boost up the price and give you nothing in return.

At PC Brand we take their share of the profit and give it directly to you in a lower system price and in better service and support. The Best in the Business.

This formula works! And it's why more experienced PC buyers are leaving the retail channel behind and joining the ranks of tens of thousands of Satisfied PC Brand Clients. Working with the Best in the Business.

PC BRAND

Finally, a computer company that specializes in satisfied customers.

CIRCLE 303 ON READER SERVICE CARD

PCM 91-1

height 182MB hard disk in our evaluation unit formats to 150MB and is rated at 18 milliseconds.

Dyna offers a number of hard disk options for the Work Master, ranging from a 40MB IDE device for \$320 to a 600MB SCSI model for \$2,100.

On PC Magazine Labs' BIOS Disk Seek test, the CPC hard disk outperformed its rating. In other respects, the machine's performance was mixed, ranking among the fastest on our video tests and among the slowest on our processor tests. On our small- and large-record DOS File Access tests the machine's performance was decidedly average.

For expandability, the Work Master's motherboard offers two 8-bit (one of those doubles as the 32-bit memory board slot) and six 16-bit slots. What's more, the interior of the machine is nicely finished, making it easy to swap boards in and out. Fully configured with I/O card, video adapter, and UltraStor integrated floppy-and-hard disk controller, the number of available slots drops to five, which is average for this class of machine.

Dyna Micro does not bundle operating system software with the Work Master, although the tested version of the machine came with it. DOS 4.01 and 3.3 are available, both for \$65.

Dyna Micro goes beyond a lot of vendors in providing service and support. The machine is covered by a one-year parts-and-labor warranty, with on-site service provided by Integrated Automation. Dyna Micro also provides unlimited toll-free telephone support.

As either a personal workstation or a file server, Dyna Micro's Work Master has the equipment to live up to its name.

EVEREX SYSTEMS INC.

Everex Step 386/33

by Fredric Burke

If the Everex philosophy could be summed up in only a few words, it would be "speed and more speed." That's borne out in the performance of the company's \$6,697 Everex Step 386/33, which delivered consistently fast scores on PC Magazine Labs' benchmark tests.



Everex Step 386/33, \$6,697.

Prices for this high-performance desktop machine start at \$4,899, including 2MB of RAM, a 64K processor RAM cache, a 1.2MB TEAC floppy disk drive, one parallel and two serial ports, a 101-key keyboard, and DOS 4.01. For \$6,697, our evaluation unit came with 4MB of RAM, the 64K cache, a 17-millisecond 182MB Imprimis hard disk that formatted to 160MB, the 1.2MB floppy disk drive, and an Everex Viewpoint Super VGA adapter and Everex Eversion monitor.

In the latest version of the Step, Everex continues with its jumperless and DIP switchless motherboard. In place of the AMI chip set used in other Everex machines, the Step 386/33 uses Everex-designed discrete logic. The BIOS, which is based on licensed AMI source code that has been modified by Everex, now resides in an EPROM chip, instead of in a more traditional chip set. It supports system BIOS shadowing, but not video BIOS shadowing.

You can set the processor to run at either 8 MHz, 16 MHz, or 33 MHz through a front-panel toggle switch, which is normally hidden from sight by a smoked plastic panel; also on the front panel are the power and reset switches and an LED diagnostics display. The I/O bus runs at a brisk 11 MHz, but it will default to 8.25 MHz when running slower boards.

Designed with the power user in mind, the Step 386/33 uses 64K as its minimum configuration; this can be boosted to a maximum of 256K. In our evaluation unit the 64K of static RAM comprised 35-nanosecond 64K SIMMs. The maximum 32-bit RAM usable by the system is 16MB. The 4MB of page-mode system memory on our evaluation unit's motherboard was made up of 100-ns. SIMMs. Memory upgrades in 2MB, 3MB, and 4MB chunks are \$199, \$299, and \$399, respectively. The Step will also support both an Intel 80387 and a Weitek 8137 math coprocessor simultaneously.

Despite its large size, the 6.3- by 16.3- by 21.5-inch Step 386/33 offers only average room for expansion—two 8-bit and six 16-bit slots. One of the 8-bit slots is taken up with the I/O card, while a 16-bit slot goes to the Everex Viewpoint video card and another to the Everex integrated ESDI disk controller. The Step has space for five half-height storage devices, with two hidden behind the front panel's horizontal cooling slots. A 200-watt power supply with four device connectors completes the hardware picture.

Along with DOS 4.01 Everex includes *Quick Step*, an OEM version of *PC-Kwik*. OS/2 is available for \$175, and *Step Manager 386*, Everex's expanded memory

FACT FILE

Dyna Work Master 386 33 Plus
Dyna Micro Inc., 30 West Montague Expy., San Jose, CA 95134; (800) 336-3962.

List Price: With 4MB RAM, 1.2MB and 1.44MB floppy disk drives, color VGA display subsystem, one parallel and two serial ports, game port, \$6,350; with 64K processor RAM cache, 182MB hard disk, two 1.2MB and one 1.44MB floppy disk drives, Super VGA display subsystem, \$7,995.

In Short: This intelligent but expensive update of Dyna Micro's Dyna 33 Series offers average 33-MHz performance and expansion options.

CIRCLE 630 ON READER SERVICE CARD

FACT FILE

Everex Step 386/33
Everex Systems Inc., 48431 Milmont Dr., Fremont, CA 94538; (800) 356-4283.

List price: With 2MB RAM, 64K processor RAM cache, 1.2MB floppy disk drive, DOS 4.01, \$4,899; with 4MB RAM, 160MB hard disk, Super VGA display subsystem, \$6,697.

In Short: The latest in the Step series combines speed with technical sophistication. Everex has lowered its price and adopted a discrete-logic-based motherboard to improve its earlier version of the unit.

CIRCLE 631 ON READER SERVICE CARD

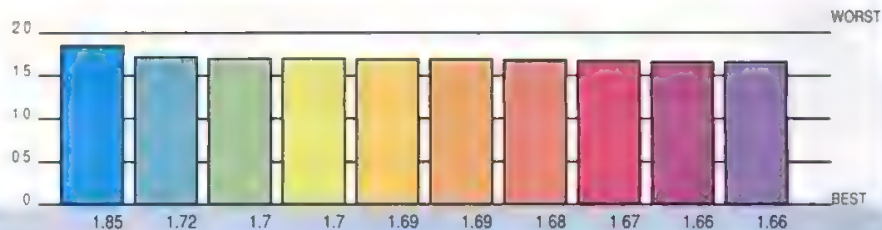


BENCHMARK TESTS: 33-MHz 386-BASED PCs

No single machine stands out when we look at all the tests, but a video chip set does. Six of the eight machines that finished in the top four on each of our video tests used Tseng Laboratories chip sets on either Diamond or Orchid cards.

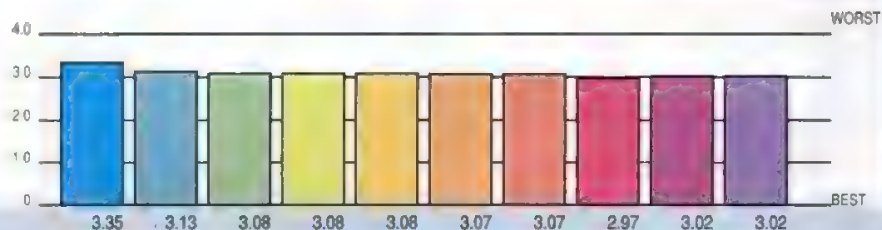
80386 Instruction Mix

The **80386 Instruction Mix** benchmark test times a series of tasks specific to the 80386 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.



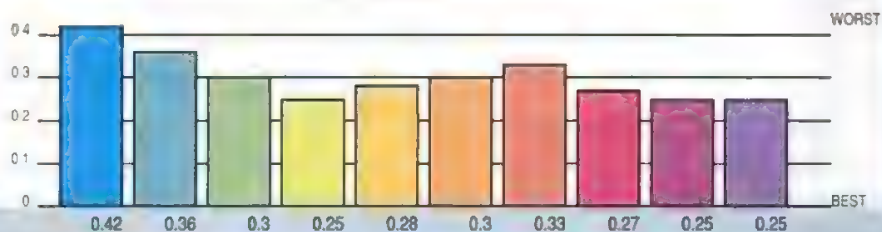
Floating-Point Calculation Without Coprocessor

The **Floating-Point Calculation Without Coprocessor** benchmark test sets up a floating-point emulation program in RAM and then exercises the processor and tests RAM access speeds during floating-point calculations.



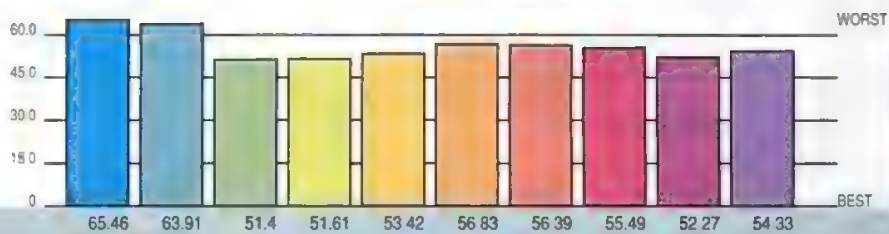
Conventional Memory

The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at slower access speeds.



DOS File Access (Small Records)

The **DOS File Access (Small Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.



Tandy 4033 LX
PC Craft 2401/33
Amaz 386/33 Business Station
Destiny 386 1000
Austin 386/33 Winstation
Dyna Work Master 386 33 Plus
Poly 386-33PT
DSR/Tiger 386
*Compaq Deskpro 386/33
Dataworld Data 386-33

* Reported for comparison.

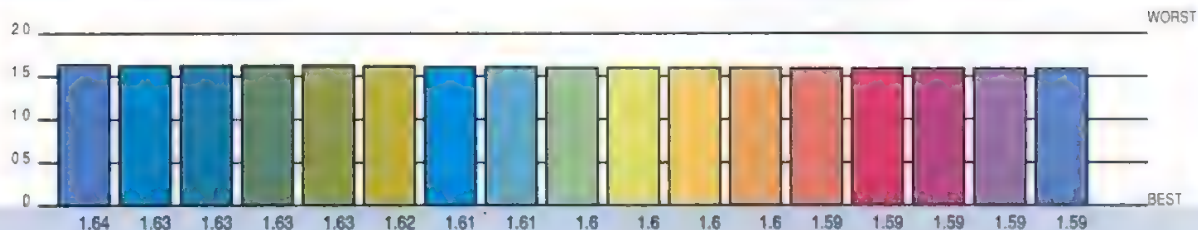
COMPUTERS

33-MHz 386 PCs

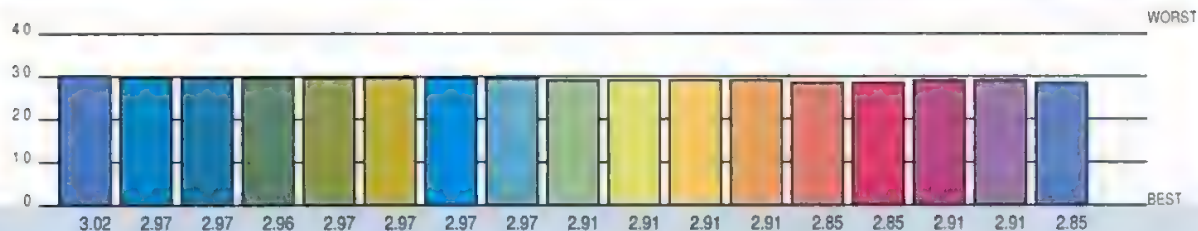
PC Labs tested 26 33-MHz 386 computers for this issue. We tested the units with buffers left at their default value and with system and video BIOS shadowing enabled wherever possible. Video shadowing should produce faster times on benchmark tests. Whether or not it does, or whether a machine performs well without it, is a good indication of the quality of the video architecture.

We ran all disk benchmark tests without the benefit of software disk caching. For processor, memory, and video benchmark tests, the margin of error is 0.5 seconds, so take this into account when making purchasing decisions based primarily on speed.

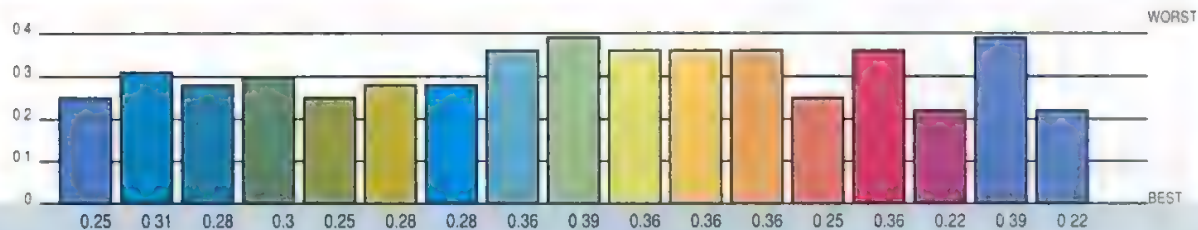
Elapsed Time (seconds)



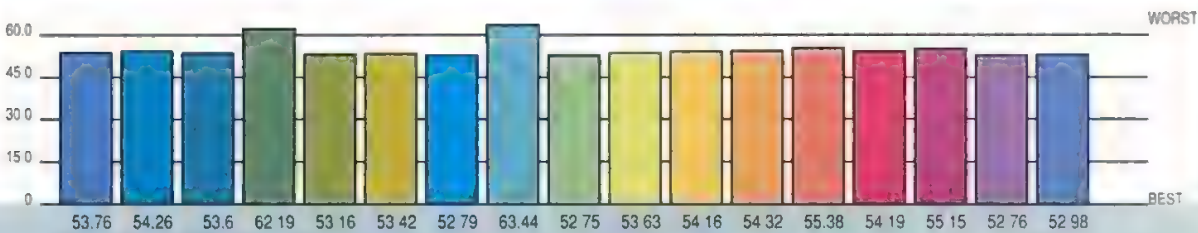
Elapsed Time (seconds)



Elapsed Time (seconds)



Elapsed Time (seconds)



Dell Systems 333D Bus 386-33
 PC Brand 386/33 Cache Desktop
 Spear Ultra 386/33
 Tangent 333c
 Gateway 386-33 Cache
 Blackship 386-33
 DTK Keen-3304
 Boss 3633-S
 Micro Express ME 386-33
 Tri-Star 386-33
 FiveStar 386-33
 Arche Legacy 386-33 Workstation
 Club Hawk I
 Everex Step 386-33
 Flash 386-33
 Zeos 386-33

CONTINUES

With HP's enhanced OCR capabilities,

chirrupy / chloroquine

246

to make a series of sharp, sucking sounds with the lips, as in urging a horse on — *n.* a chirruping sound — *chirrupy adj.*

chirurgeon (ki rər'jən) *n.* [altered, after *L.* forms < *ME* *cirurgian* < *OFr* *cirurgien* < *ME* & *OFr* *cirurgie* see *SURGERY*; archaic var. of *SURGEON* — *chirurgical* (-jər ē) *n.* — *chirurgicaly* (-ji kəl) *adv.*

chisel (chiz'əl) *n.* [NormFr (OFr *cisel*) < VL **cisellum*, for *L.* **caesellum* < *caesus*, pp. of *caedere*, to cut; see *-CIDE*] a hand tool with a sharp, often wedge-shaped, blade for cutting or shaping wood, stone, etc., specif., such a tool that is driven with a mallet or hammer — *vt.*, *vi.* -*eled* or -*elled*, -*eling* or -*elling* 1 to cut or shape with a chisel 2 [Colloq.] a) to take advantage of by cheating, sponging, etc. b) to get (something) in this way — *chisel in* [Colloq.] to force oneself upon others without being asked or welcomed — *chisel'er* or *chis'eler n.* **chis-eled** or **chis-elled** (-eld) *adj.* 1 cut or shaped with a chisel 2 finely wrought, as if shaped by a chisel



CHISEL

Chis-holm Trail (chiz'əm) [after Jesse Chisholm (c. 1806-68), U.S. frontier scout who established it] cattle trail from San Antonio, Tex., to Abilene, Kans. important from 1865 until 1880's

chi-square (ki'skwər) *n.* a statistical method used to test whether the classification of data can be ascribed to chance or to an underlying law

chit' (chit) *n.* [ME *chitte*, prob. var. of *kittie*, for *kitten*] 1 a kitten 2 an immature or childish girl

chit? (chit) *n.* [Chitzy Brit] a short note or letter; *mail chit* a spot; see *CHITZ* 1 [Chiefly Brit] a short note or letter; *mail chit* a spot; see *CHITZ* 2 a voucher of a small sum owed for drink, food, etc.

Chita (che'ta) city in SE RSFSR, near the Mongolian border; pop. 336,000

chit chat (chit'chat) *n.* [redupl. of *CHAT*] 1 light, familiar, informal talk, chat, small talk 2 gossip

chitin (ki'tin) *n.* [Fr *chitine* < Gr *chiton* see *CHITON*] a tough, horny polysaccharide, (C₆H₇NO₂)_n, secreted by the epidermis and forming the main bulk of the outer covering of insects, crustaceans, etc. — *chitin'ous* (-əs) *adj.*

chit-lins or **chit-lings** (chit'linz) *n.pl.* dial. var. of *CHITTERLINGS*

chiton (ki'tən, -tən) *n.* [Gr *chiton*, garment, tunic, coat of mail; see *TUNIC*] 1 a loose garment of varying length, similar to a tunic, worn by both men and women in ancient Greece 2 any of a class (Polyplacophora) of mostly small, ovoid marine mollusks, having a dorsal shell consisting of eight articulating calcareous plates and a ventral foot

chit-to-san (kit'tə san) *n.* a polysaccharide derived from chitin, that absorbs heavy metals while in solution; it is used in industry, esp. to purify waste water

Chit-ta gong (chit'tə gōŋ, -gāŋ) seaport in SE Bangladesh, near the Bay of Bengal; pop. 1,392,000

chit-ter (chit'tər) *vi.* [ME *chiteren*; orig. echoic] 1 to twitter 2 [Brit. Dial.] to shiver with cold

chit-ter-lings (chit'tər līŋz, occas. chit'tər līŋz) *n.pl.* [ME *chitterlīng*, a small bird; *chit* < *chit*, to chirp; *ling* < *ling*, to chirp]

Chlor or **Chlor** (klōr) *n.* [L. < Gr *Chlor*, blooming, certain feminine name 2 see *DAPHNIS AND CHLOR*] **chlor-** (klōr) combining form *CHLORO-*: used before a vowel **chlor-ac-ne** (klōr ak'nē) *n.* an acne-like skin disorder caused by exposure to chlorinated hydrocarbons **chlor-al** (klōr'al) *n.* [CHLOR(O)- + AL(COHO)] 1 a colorless liquid, CCl₃CHO, with a pungent odor, prepared by the action of chlorine on alcohol, used in the manufacture of DDT 2 *chloral hydrate*

chloral hydrate a colorless, crystalline compound, CCl₃CH₂OH, used chiefly as a sedative

chlor-amine (klōr'a mēn, klōr'a mēn'; klōr'am'ēn) [CHLOR(O)- + AMINE] a colorless, pungent liquid, NH₂Cl, used by the action of ammonia on some hypochlorite

chlor-phen-icol (klōr'am fēn'ī kōl, -kōl) *n.* [CHLOR(O)- + AMINE + PHEN- + ICOL] an antibiotic, C₁₂H₉Cl₂N₂O₆, prepared synthetically or isolated from a bacterium (*Streptomyces venezuelae*); it is used against a wide variety of bacterial and rickettsial diseases and against some viruses

chlor-ate (klōr'at, -it) *n.* a salt of chloric acid

chlor-cy-cline (klōr'at'kīn) *n.* an antihistamine, C₁₇H₁₅ClN₂

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Now you can take a page of this. A paragraph of that. Combine them with a few images. And quickly come up with one very impressive document. The HP ScanJet Plus scanner can read everything from a magazine article to a balance sheet. Then it stays on the job so you can easily fine-tune, or make major changes to, everything you've scanned.

The affordable, 8-bit ScanJet Plus is supported by a wide variety

of third-party OCR and graphics software packages. HP's optional



it's easy to make chocolate moose.

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production due to
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+ THI- + AZ- + IDE]
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247

chlorosis / cholinesterase

chock-a-block (-ə blāk') *adj.* [see prec & BLOCK] 1 *Naut.* a) pulled so tight as to have the blocks touching (said of a hoisting tackle) b) hoisted all the way up. ad a signal flag 2 -
chock-full (chāk'fool') -
cheke, cheek +
full as -

choke.
[THOKE] as

via Fr
powder
ted and
1 sugar
-adj.
oc'o.

arge

chlorosis / cholinesterase

a-block (-ə blāk') *adj.* [see prec. & BLOCK] 1 *Naut.* a) pulled so tight as to have the blocks touching (said of a hoisting tackle) b) hoisted all the way up. as a signal flag 2 crowded or jammed -*adv.*
ck-full (chāk'fool') *adj.* [ME *chokketul*, *cheketull* - *choke*, *cheke*, *cheek* + *-ful*; now often assoc. with *chock*, *choke*] as full as possible; filled to capacity

chocola (chōk'ə let, chāk'ə) *n.* [? via Fr *chocolat* < Sp *chocolate* < Nahuatl *chōkōlatl*] 1 a paste, powder, syrup, or bar made from cacao seeds that have been roasted and ground 2 a drink made of chocolate, hot milk or water, and sugar 3 a candy made of or coated with chocolate 4 reddish brown -*adj.*
1 made of or flavored with chocolate 2 reddish-brown -*choc'o.*
chocolate moose /c'hak-(e)let/mus/n, pl moose: a large member of the elk family dipped in chocolate.

cho-co-la-tier (chō'kə lə tir') *n.*
a maker or seller of chocolate candies, esp. fancy or expensive ones
Choc-taw (chāk'tō') *n.* [Choctaw *chahta*, a self-designation] 1 *pl.* -*taws* or -*taw* a member of a North American Indian people who lived in S Mississippi, Alabama, Georgia, and Louisiana and now live in Oklahoma and Mississippi 2 the Muskogean language spoken by this people
choice (chois) *n.* [ME & OFr *choisir*, to choose < *choisir*, to taste, test; see



chocolate moose 1

able part 5 a variety
alternative



text scanning software, AccuScan, simplifies the scanning process by recognizing the layout of even the most complicated material. Including multi-column pages and numerical tables. AccuScan automatically separates text from graphics, making it easy for you to pick and choose the information you want. An optional twenty-page automatic document feeder makes you even more efficient.

The ScanJet Plus gives you a head start. With one-button automatic text scanning. Live preview for instant feedback on image quality. And auto exposure, which works like a point and shoot camera. To make things even easier, it features on-line help.

HP has added all these impressive capabilities to a scanner known for its superior image scanning. The ScanJet Plus reads 256 levels of gray for smooth shading and more realistic graphics.

At only \$2,190* the ScanJet Plus makes perfect sense for any business interested in being more productive. And more professional. For more information and the name of your nearest authorized HP dealer, call 1-800-752-0900, Ext. 1666. And even if you never make chocolate moose, you'll have a recipe for success.



HEWLETT
PACKARD



BENCHMARK TESTS: 33-MHz 386-BASED PCs

DISK BENCHMARK TESTS

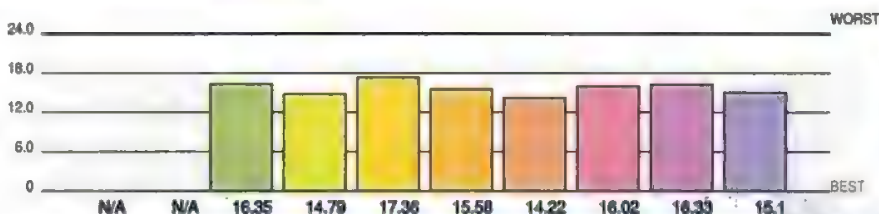
DOS File Access (Large Records)

The **DOS File Access (Large Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded.



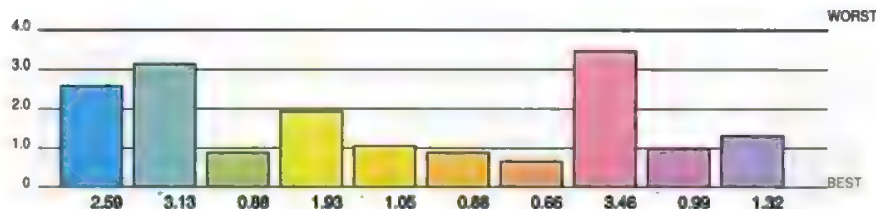
BIOS Disk Seek

The **BIOS Disk Seek** benchmark test measures mechanical track-to-track disk drive access times. Fast times are helpful with programs such as databases, which often store and must later find data in many separate places on a drive.



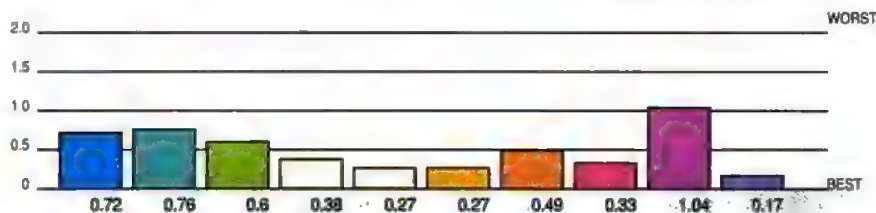
Direct to Screen

The **Direct to Screen** benchmark test indicates the speed of the video adapter memory. Good scores indicate that information can get to the screen quickly, particularly for programs that avoid the computer's BIOS and go directly to the screen.



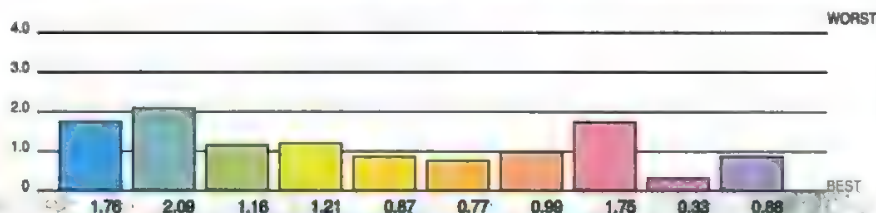
Video BIOS Routine Without Scrolling

The **Video BIOS Routine Without Scrolling** benchmark test measures how quickly the BIOS on the video adapter writes text data to the screen. Fast video writing helps with programs that show full or partial screens of data without scrolling the screen.



Video BIOS Routine with Scrolling

The **Video BIOS Routine with Scrolling** benchmark test measures how fast the video adapter can scroll the screen, moving the display up one line at a time. Good performance is helpful for scrolling through word processing or spreadsheet files.

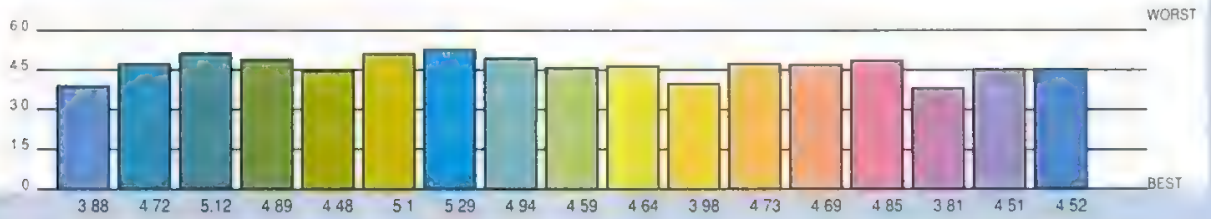


N/A—Not applicable: The machine could not complete this test.

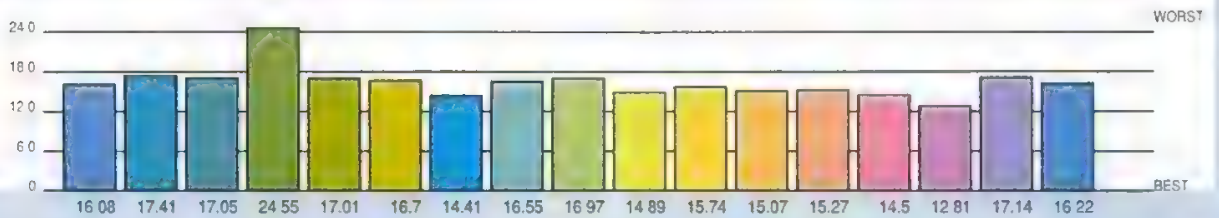
* Reported for comparison.

COMPUTERS 33-MHz 386 PCs

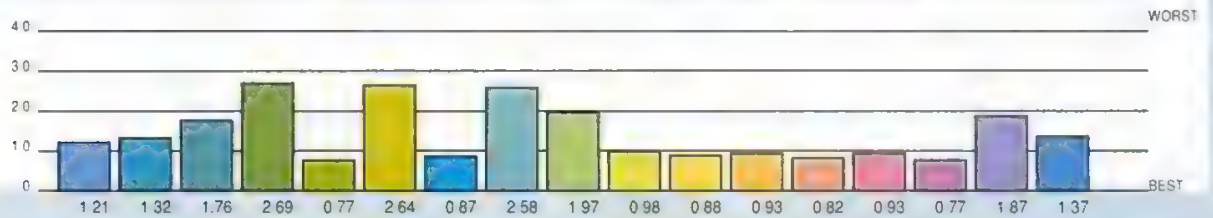
Elapsed Time (seconds)



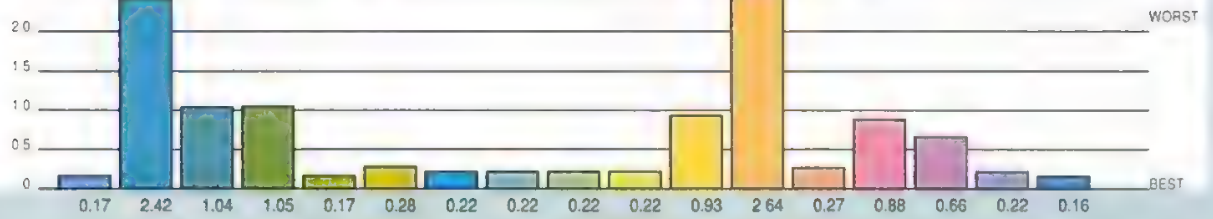
Elapsed Time (milliseconds)



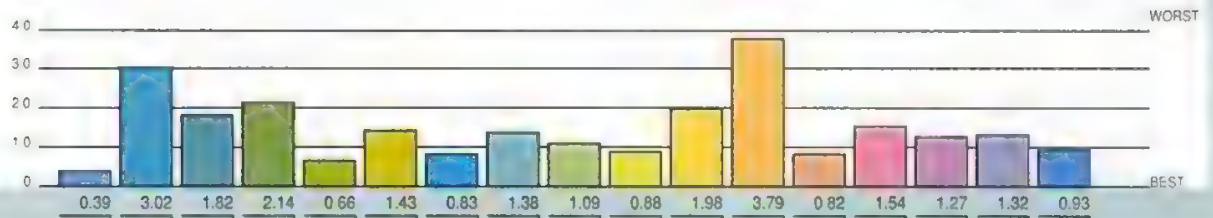
Elapsed Time (seconds)



Elapsed Time (seconds)



Elapsed Time (seconds)



Dell Systems 333D Bus 386-33 PC Brand 386/33 Cache Desktop Spear Ultra 386/33 Tangent 333c Gateway 386-33 Cache Blackship 386-33 DTK Keen-3304 Boss 3633-S Micro Express ME 386-33 Tri-Star 386-33 FiveStar 386-33 Arche Legacy 386-33 Workstation Club Hawk I Everex Step 386-33 Flash 386-33 Zeos 386-33

CONTINUES



3" x 8" x 11"

THE BRICK™

The fastest 386SX™ with 212 MB HD, 8 MB RAM, 1024 x 768 VGA, and a built-in modem weighs just 8.7 lbs.!

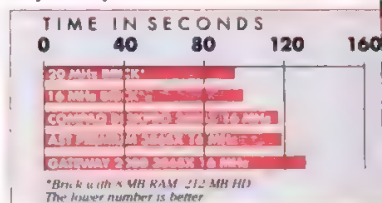
This new generation PC is remarkable for the performance and the practicality it provides. The Brick is powerful enough for the most demanding applications, while its elegance, quietness and size make traditional PC's seem downright obtrusive by comparison.

More Practical Than a Portable

For multisite computing, the Brick offers an alternative to the usual trade-offs of laptops or multiple PC's. Just keep your preferred keyboard and full size monitor, plus power supply at your regular destinations and carry only the 8 lb. Brick in between. You'll save half the cost, half the weight and all the hassle of coordinating files between multiple machines.

Blazingly Fast

Compared to published reports of all 386SX machines tested to date by PC Magazine and Byte, the Brick offers superior performance on the



Time to complete PC Magazine's full benchmark test set.



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for Technical Excellence



Ergo Brick
Ergo Computing, Inc.

"A Tote-able that Outperforms the Desktops..."

Consistently outperforms both Compaq's and IBM's 386SX on the PC Labs computer benchmark tests...Ergo's Brick maintains the functionality of a Desktop PC within a small form factor"

— PC MAGAZINE, Sept. 1990



Fits in half a briefcase, leaving room for full-sized folders, notebooks, etc.

aggregate of system, video and hard disk benchmarks.

Massive Hard Disk

Bricks are available with 16 or 20 MHz 386SX, 1-8 MB of RAM, a fast 44, 104 or 212 MB Conner or Teac IDE hard disk, and a 387 coprocessor socket. A 2,400 bps Hayes compatible modem is standard.

The fast VGA graphics feature up to 1024 x 768 non interlaced resolution with a full 1 MB of video memory. In fact, the Brick's video performance is twice as fast as the average of 42 386SX systems tested by *PC Magazine*! This makes an enormous difference in the perceived "response" of the system, especially if you're running graphically intensive applications like Windows or Desktop Publishing.

Surprisingly Expandable

The Brick is only about the size of a ream of copier paper, yet you can still add up to two ISA half cards internally, (one card with a floppy drive). A docking port allows easy, drop-in connection to our Docking Terminal, (\$249, available Q1 1991) which instantly hooks up all cables and provides another 16-bit 3/4 length slot. The "stretch" version of the Brick accommodates full length cards.



Optional back-lit VGA super twist LCD display.

Totally Versatile

When you need to travel, just add the optional VGA LCD module, (\$895, available Q1 1991) and our Brick Bag for a completely self-contained, AC powered portable system.

Satisfaction Guaranteed

Because we are a direct selling manufacturer, we have a direct interest in the complete satisfaction of each and every customer. To ensure that satisfaction, **Ergo** offers: a 30-day money back guarantee, a One Year Warranty, unlimited 800-line support and our exclusive Advanced Diagnostics via modem.

Free Catalog

You'll find complete information on all Brick systems, plus a full complement of enhancements including monitors, tape backup units, external 5.25" floppies, cases, FAX and network boards and more in our free 32-page catalog. Ergo also offers "traditional" 386 and 486 computers from 16 to 33 MHz, starting at just \$1,895.

Order your Brick today, Factory-Direct! Call us at **1-800-633-1925** (or 508-535-7510) and we'll help select the system that best meets your needs.



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Includes

- ▲ 16 MHz Intel 386SX
- ▲ 1 MB RAM, Exp. to 8 MB
- ▲ 44 MB hard disk with password protection
- ▲ 16-bit half card exp. slot

Standard Features

- ▲ 1024 x 768 VGA controller with 1 MB video RAM
- ▲ 2,400 bps modem
- ▲ 3.5" 1.44 MB floppy
- ▲ 2 serial & 1 parallel port
- ▲ 864k DOS capable
- ▲ One Year Warranty
- ▲ Freight included

\$2,695

with 101 Keyboard & 12" Mono VGA Monitor

\$2,995

with 101 Keyboard & 14" Color VGA Monitor

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PROCESSOR, MEMORY, AND DISK BENCHMARK TESTS: COMPOSITE VIEW

Top honors on the processor and memory benchmark tests went to the Zeos 386-33. It finished very strongly on all three tests, with the Everex Step 386/33 and Arche Legacy 386-33 Workstation just slightly behind. On the processor tests, however, we found only insignificant differences among most of the machines tested.

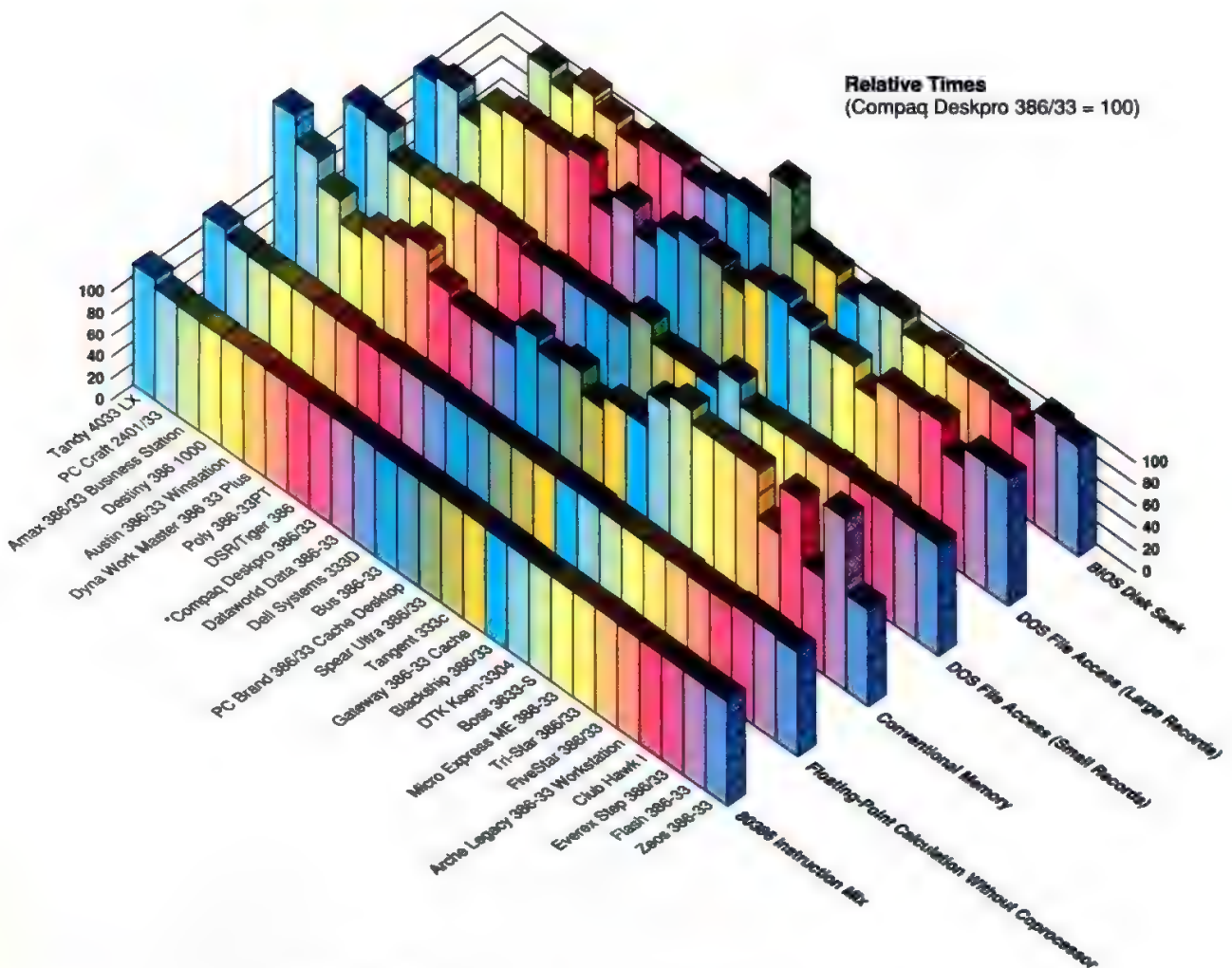
A more telling analysis is to look at the performers that fell to the bottom of the pack. The Tandy 4033 LX holds the dubious distinction of turning in the slowest overall performance on the processor and memory tests. While the Zeos, Everex, and Arche units had processor RAM caches that ranged from 64K to 128K, the Tandy used an Intel cache controller with only 32K of RAM installed. Add that to the 100-nanosecond SIMMs used as the add-in card memory and you get unspectacular results. The PC Craft 2401/33, which also fell behind in these tests, used an Intel controller with 32K RAM cache as well.

Despite its BIOS Disk Seek time of 16.35 milliseconds, the Amax 386/33 Business Station's hard disk scored at the top on both of our DOS File Access benchmark tests. The system uses a

Maxtor ESDI drive with an UltraStor controller. Everex's CDC ESDI drive and UltraStor controller also turned in an excellent BIOS Disk Seek time of 12.81 milliseconds.

The Tandy and PC Craft systems, which did poorly on the processor and memory tests, also turned in the worst scores on the small-record DOS File Access test. On the other hand, Tandy's Seagate SCSI drive, with its Adaptec controller, and PC Craft's Maxtor SCSI drive, with an Always Technology controller, did bounce back to turn in faster-than-average times on the large-record test. Because these two machines used SCSI drives, they were incompatible with our BIOS Disk Seek test.

At the bottom of the pack was the Spear Ultra 386/33, with its Toshiba ESDI drive and DTC controller. A better hard disk system might have improved that machine's 24.55-ms. BIOS Disk Seek time, poor small-record test score, and below-average large-record score.



* Reported for comparison.

CONTINUES



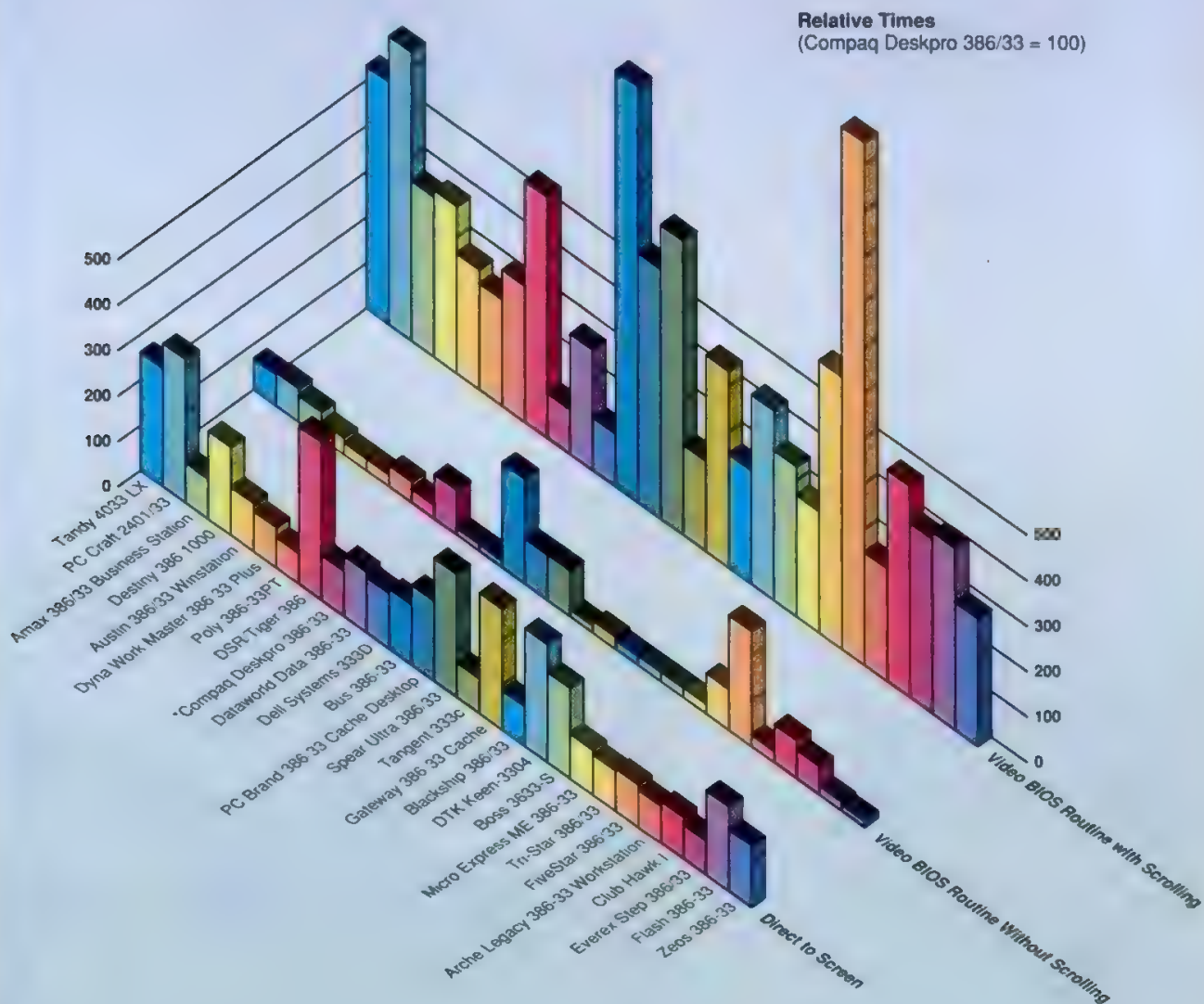
VIDEO BENCHMARK TESTS: COMPOSITE VIEW

The best overall video performance came from the Tangent 333c, which also performed well in our roundup of 20-MHz 386SXs (*PC Magazine*, November 27, 1990). The Orchid card, with its Tseng chip set, gave this machine a definite edge. Close on its heels was the Dell 333D, with a Western Digital chip set, which incorporates its video onto the motherboard.

Special mention should be made of the Poly 386-33PT, which took first place on the Direct to Screen test, and of the Everex Step 386/33, which tied for second place on the test, even without shadowing. The DSR/Tiger 386, with a Trident chip set and DSR

card, and the PC Craft 2401/33, which used its own PC Craft video card and a Paradise chip set, showed less-favorable results on this test.

The Video BIOS Routine tests proved to be a stumbling block to the FiveStar 386/33 and the Bus 386-33. The performance of the former system's STB card and chip set can be explained by the lack of video shadowing. By contrast, the Bus computer used its own video card with a Trident chip set and shadowing, and it still placed second from the bottom on these two tests.



* Reported for comparison.

ENDS

manager, is \$39.95. The Step 386/33 comes with a one-year parts-and-labor warranty, with on-site service provided as well.

Together the Step 386/33's components deliver blazing speed. When it wasn't the fastest of the group in our tests, the FCC Class B-certified Step 386/33 turned in considerably faster-than-average times—with one exception. On our small-record DOS File Access test its measured time was about average.

By refining the design of the Step machine we tested last year and lowering its price, Everex has produced a 33-MHz computer that should satisfy anyone's craving for speed. That's a step in the right direction.

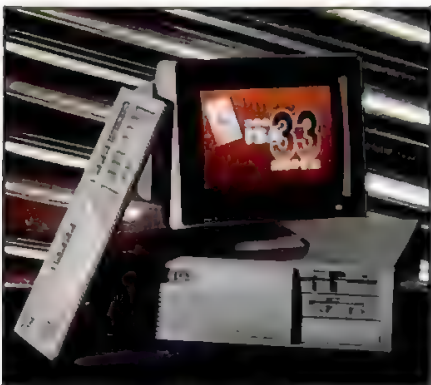
GATEWAY 2000

Gateway 386-33 Cache

by Fredric Burke

The Gateway 386-33 Cache carries on Gateway 2000's approach to systems design and marketing, with conservative engineering and a rock-bottom price. And the \$3,695 price of the tested configuration makes the machine one of the least expensive in the roundup.

Although the 386-33 Cache is inexpensive, it isn't cheaply made. For under \$4,000 you get a desktop system that's full

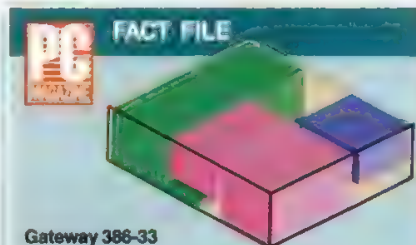


Gateway 386-33 Cache, \$3,695.

of brand-name parts, including 4MB of RAM, a 64K processor RAM cache, a 17-millisecond 150MB Seagate hard disk, a 1.2MB and a 1.44MB Epson floppy disk drive, an ATI VGA Wonder adapter and a Mag Computronics Super VGA monitor, one parallel and two serial ports, a 101-key Key Tronic keyboard, DOS 4.01, *Microsoft Windows 3.0*, EMM 386.sys (an ex-

tended memory manager), and a serial Microsoft Mouse. The machine is powered by a 200-watt Powertronics power supply.

The 5.3- by 21- by 16.5-inch 386-33 Cache has room for five half-height drives,



Gateway 386-33 Cache

Gateway 2000, 610 Gateway Dr. North, Sioux City, SD 57049; (800) 523-2000, (605)-232-2000. List price: With 4MB RAM, 64K processor RAM cache, 150MB hard disk, 1.2MB and 1.44MB floppy disk drives, Super VGA display subsystem, one parallel and two serial ports, DOS 4.01, *Microsoft Windows 3.0*, Microsoft Mouse, \$3,695.

In Short: The Gateway 386-33 Cache offers conservative engineering, average performance, and a rock-bottom price.

CIRCLE 632 ON READER SERVICE CARD

two of which are mounted behind the faceplate. The chassis is sturdily constructed and well-braced; you won't look inside this unit to discover an annoyingly flexible motherboard, as you will with many low-cost machines. On the front of the system unit are reset and turbo switches, an LED turbo indicator, and a keyboard lock.

The FCC Class B-rated 386-33 Cache employs a Micronics motherboard and chip set. Phoenix provides the BIOS, which offers both video and system BIOS shadowing. The Micronics motherboard allows both an Intel 80387 and a Weitek 3167 math coprocessor to be run simultaneously; it provides additional support for a Weitek 4167. The motherboard uses an Intel 82385 cache controller for the nonadjustable 64K cache of 25-nanosecond static RAM.

The 386-33 Cache can use a maximum of 16MB of 32-bit memory, with up to 4MB on the motherboard; the 1MB SIMMs in our tested unit were rated at 70 ns. It will cost you \$425 to add a 32-bit memory board with 4MB and \$850 for a board with 8MB. This additional 70-ns. RAM is packaged in the same fashion as the system RAM.

In its complement of expansion slots, the large 386-33 Cache differs from its predecessor, the 386-33 Dream Machine. Whereas the Dream Machine offered one

8-bit, one 32-bit, and six 16-bit slots, the 386-33 Cache packs one 32-bit and seven 16-bit slots. With a 16-bit UltraStor integrated disk controller, an I/O card, and a video card installed, you'll have four 16-bit slots left open for expansion.

Parts are guaranteed for a year, and labor is free for the lifetime of the unit. TRW provides on-site service, and Gateway backs up its machines with toll-free telephone support and parts shipping. Gateway also offers a 30-day money-back guarantee.

Neither spectacularly fast nor annoyingly slow, the Gateway 386-33 Cache was an average performer on our tests. And that's certainly acceptable, considering its better-than-average price.

MICRO EXPRESS

Micro Express ME 386-33

by Fredric Burke

While some manufacturers completely revamp their machines, Micro Express has made minimal changes to its ME 386-33, which is fundamentally the same machine that it was when we reviewed it a year ago ("Speed to Burn: 22 of the Fastest 386s," *PC Magazine*, February 13, 1990). What we said then is true now: The ME 386-33 has not lost a step to its competition.

With a price of \$4,124 for the tested configuration, the small-footprint ME



Micro Express ME 386-33, \$4,124.

386-33 is less expensive than many of the 33-MHz machines in this roundup. For that price you get 4MB of RAM, a 64K processor RAM cache, a 16-millisecond 150MB Imprimis hard disk, a 1.2MB YE



- 80C286-12 Microprocessor
- 1MB Standard
- Built-in 20MB Hard Disk
- Built-in 3.5" 1.44MB Microfloppy
- 10" Supertwist LCD with CCFT Backlit
- 640x480 Pixels with 32 Gray Scale
- Changable and Rechargeable Battery
- 7lbs 12"(W) x 16.5"(D) x 2"(H)

286

Notebook-Sized 386SX VGA Laptop



WEIGHTS 11.3 lbs.
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- Intel 80386SX-16 CPU
- 2MB RAM expandable to 6MB
- Paper white LCD, 9" diagonally
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- Notebook-size 12.8"x12.4"x2.36"
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- 9.5" 9.28mm Dot Pitch VGA Monitor
- 1 Half-Height Drive Slots
- Full-Expansion Slots
- Clicking 84 Keys w/ LEDs
- Reinforced Aluminum Frame
- Dimensions: 16"(W) x 8.4"(H) x 16"(D)
- Weights 29 lbs in Kit Form

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114.1 MHz*



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\$1,399

MONO \$899



25 MHZ 486 ISA VGA

80486-25 CPU

- 4 Megs Memory RAM
- 155MB 17ms Hard Disk
- ESDI Controller w/32k Cache
- Bus 1024x768 VGA Multisync Monitor
- ATI 1024x768 512k VGA Card
- 1.2MB and 1.44MB Drives
- Enhanced 101-Key Keyboard
- 2 Serial, 1 Parallel, 1 Game
- 7-Bay Vertical Case w/220w

33 MHZ 386 VGA

80386-83 CPU

- 64k SRAM Cache Memory
- 4 Megs Memory RAM
- 155MB 17ms Hard Disk
- ESDI Controller w/32k Cache
- Bus 1024x768 VGA Multisync Monitor
- ATI 1024x768 512k VGA Card
- 1.2MB and 1.44MB Drive
- Enhanced 101-Key Keyboard
- 2 Serial, 1 Parallel, 1 Game
- 7-Bay Vertical Case w/220w

25 MHZ 486 EISA VGA

80486-25 CPU

- 64k SRAM Cache Memory
- 4 Megs Memory RAM
- 155MB 17ms Hard Disk
- ESDI Controller w/32k Cache
- Bus 1024x768 VGA Multisync Monitor
- ATI 1024x768 512k VGA Card
- 1.2MB and 1.44MB Drives
- Enhanced 101-Key Keyboard
- 7-Bay Vertical Case w/220w

25 MHZ 486 EISA VGA

80486-25 CPU

- 64k SRAM Cache Memory
- 4 Megs Memory RAM
- 155MB 17ms Hard Disk
- ESDI Controller w/32k Cache
- Eight 32-bit EISA Expansion Slots
- Bus 1024x768 VGA Multisync Monitor
- ATI 1024x768 512k VGA Card
- 1.2MB and 1.44MB Drives
- Enhanced 101-Key Keyboard
- 2 Serial, 1 Parallel, 1 Game
- 7-Bay Vertical Case w/220w
- 64k On Board Memory Optional

33 MHZ 486 EISA VGA

80486-33 CPU

- 64k SRAM Cache Memory
- 4 Megs Memory RAM
- 155MB 17ms Hard Disk
- ESDI Controller w/32k Cache
- Eight 32-bit EISA expansion Slots
- Bus 1024x768 VGA Multisync Monitor
- ATI 1024x768 512k VGA Card
- 1.2MB and 1.44MB Drives
- Enhanced 101-Key Keyboard
- 2 Serial, 1 Parallel, 1 Game
- 7-Bay Vertical Case w/220w
- 64k On Board Memory Optional

386SX VGA

80386SX-16 CPU

- 2 Megs Memory RAM
- 43MB 25ms Hard Disk

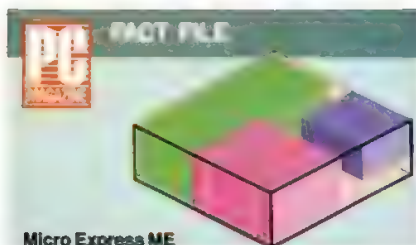
286 VGA

- 1 Meg Memory RAM
- 43MB 25ms Hard Disk

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CIRCLE 273 ON READER SERVICE CARD



Micro Express ME
386-33

Micro Express, 1801 Carnegie Ave., Santa Ana, CA 92705; (800) 642-7621.

List Price: With 4MB RAM, 64K processor RAM cache, 1.2MB or 1.44MB floppy disk drive, one parallel and one serial port, monochrome display subsystem, \$2,447; with 150MB hard disk, VGA display subsystem, one parallel and two serial ports, DOS 4.01, \$4,124.

In Short: While fundamentally the same as the unit we reviewed last year, the ME 386-33 offers some intelligent improvements, good performance, and a low price.

CIRCLE 633 ON READER SERVICE CARD

Data floppy disk drive, a Micro Express Expanded VGA video adapter, a 14-inch TVM Super Sync 2A Super VGA monitor, one parallel and two serial ports, a 102-key Maxi-Switch keyboard, and DOS 4.01. Choose between a 1.2MB or 1.44MB floppy disk drive and subtract the hard disk, one serial port, the video adapter and monitor, and DOS 4.01, and you'll wind up with the ME 386-33 in its \$2,299 basic configuration.

Inside the 7- by 15- by 16.3-inch FCC Class B-rated ME 386-33, a new AMI motherboard replaces the unit shipped in the older version. It runs the processor at a nonadjustable 33 MHz and the I/O bus at a fixed 8 MHz.

The newest version of the motherboard makes up for the most obvious failing of the original unit. Now the motherboard will support up to 8MB of 80-nanosecond SIMMs, packaged in 1Mb chips. With the older model, you had to spring for a memory expansion card for your system RAM. You may still want to buy the card to bring the 32-bit system RAM up to the machine's 16MB maximum—the same as the older model. AMI (rather than Phoenix) now makes the BIOS, and Chips and Technologies still provides the chip set.

The controller for the nonadjustable RAM cache, which is packaged in a single 25-ns. 64K DIP, is now made by AMI. The motherboard still supports either an 80387 or a Weitek 3167 unit; a Weitek daughterboard is required for simultaneous operation.

The ME 386-33's new motherboard offers the same number and types of expansion slots as the old one: a 32-bit slot for memory expansion, two 8-bit slots (one of

which contains the I/O card), and five 16-bit slots (two of which are given over to the 16-bit DPT integrated floppy/hard disk controller and the 16-bit expanded VGA video card, with its Tseng Laboratories ET400 chip set).

The ME 386-33's expansion chassis allows for three half-height drive bays and two dedicated 3.5-inch drive bays; one is an internal bay, while the other can be accessed through a vertical knockout panel to the right of the half-height bays. You can buy an optional 3.5-inch floppy disk drive for \$100, and an additional 1.2MB floppy disk drive for \$85. The unit is powered by a Solotek 200-watt power supply.

In our processor tests the Micro Express ME 386-33 tied several other machines for second place. The machine's times on most other tests were not far behind those of the leaders.

Micro Express backs the ME 386-33 with a two-year warranty for parts and labor, a reflection of the confidence it has in its machine. On-site service is not yet available, so if you can't resolve a problem over the company's toll-free support line, you'll have to send the defective part or system back to Micro Express.

The ME 386-33 is an intelligent update of a respectable first-generation 33-MHz machine. With its low price and good performance, it should give some more-expensive machines a run for the money.

NATIONAL MICRO SYSTEMS INC.

Flash 386-33

by Henry Fersko-Weiss

Finally, the Flash 386-33 is living up to its name. Thanks to the addition of a new motherboard designed for speed, the computer has vaulted to the top of PC Magazine Labs' processor tests. The system has improved its performance on our disk and video tests as well. At the same time the company has reduced the cost of the Flash 386-33 to virtually half of its original price, making it one of the least expensive 386 machines in this review group.

For a standard configuration that includes 4MB of RAM, a 64K RAM cache, a 150MB hard disk, a 1.2MB 5.25-inch floppy disk drive, a 1,024-by-768 Super VGA color monitor, one parallel and two serial ports, and DOS 4.01, you pay only \$3,199. Even if you upgrade to 16MB of

RAM and put in a 300MB ESDI hard disk, the Flash 386-33 is still exceptionally well priced at \$4,999.

The performance this inexpensive machine offers is remarkable when compared with its peers, but even more so in contrast to the showing of its previous incarnation. What once was average now is exceptional. Besides coming out at the top in PC Magazine Labs' 80386 Instruction Mix test, the Flash 386-33 tied for second on the Floating-Point Calculation test—just 2 percent slower than the fastest machines. While it performed near the bottom of the



Flash 386-33, \$3,199.

pack on the Conventional Memory test, all the computers were tightly bunched in a very narrow range.

The Flash 386-33 also had good times on the small- and large-record DOS File Access tests and respectable video test results, which were a vast improvement over the tests of the first Flash. The worst performance for the machine was on the BIOS Disk Seek test, which measures track-to-track disk drive access. But even here the Flash 386-33 was only a little over 4 milliseconds slower than the fastest machine; unless you're doing very disk-intensive work over a long period of time, you won't notice the difference in performance.

The AMI motherboard now found inside the Flash 386-33 uses more VLBI technology than the Micronics board the Flash first used, and it uses 70-nanosecond SIMMs instead of 80-ns. DIPs. The new motherboard also holds all the system's memory, a vast improvement over the previous setup of having all the RAM on a card. Using 1-megabit SIMMs, you can put up to 16MB on the motherboard. Since the system supports 4Mb SIMMs as well, the Flash 386-33 can handle up to 64MB of RAM when these larger-capacity modules become more commonly available. A full 64MB of memory would make the Flash

386-33 a robust Unix file server. The AMI motherboard also gives you greater control over the system setup, letting you enable and disable the RAM cache and relocate memory above 1MB.

While the performance and RAM capacity of National Micro Systems' machine are flashy, the case it comes in is quite plain. It's a standard beige-on-beige desktop unit with three half-height drive bays accessible through the front. The reset switch and usual array of LED lights are also on the front of the machine, but the power switch is less conveniently located on the right side and there's no turbo switch. Inside the case there are two more half-height drive bays. The backs of the drive bays come very close to the power supply, so the connecting wires to the drive controller hang over the last six or so SIMM slots. Adding modules to these slots would take some fancy finger work or force you to disconnect the drive cables.

Because the system memory is on the motherboard, there are five free slots in the standard configuration. This gives you ample though not extraordinary add-in room. The motherboard has only two DIP switches and very few jumpers on it. Most of the system setup is done through software. Another bonus of this motherboard is the slot for a 80486 adapter that will let you upgrade to a 486 processor without replacing the whole system.

To round out the features of this computer, National Micro Systems offers a 15-month warranty on all parts and labor,

which is a bit better than the customary one-year warranty. The company also says it trains its technicians by putting them to work on the production line for a year or more before they are switched over to tech support.

By combining speed, flexibility, good service, and an excellent price, National Micro Systems has moved the Flash 386-33 into a position challenging some of the better-known 386 33-MHz computers. Before you decide to buy a more recognizable brand name, you should consider the pluses of this machine, with a name to match its performance.

PC BRAND INC.

PC Brand 386/33 Cache Desktop

by Henry Fersko-Weiss

The new motherboard that qualified PC Brand's 386/33 Cache Desktop for inclusion in this review is smaller, faster, and more reliable than its predecessor. This design change has allowed PC Brand to increase the number of drive bays and yet produce a more compact desktop case, reducing its already good price in the process.

The cost for a standard configuration of the Cache Desktop—4MB of RAM, a 64K processor RAM cache, a 143MB hard disk, one high-density floppy disk drive, a 1,024 by 768 color Super VGA monitor, one parallel and two serial ports, and DOS 4.01—is \$3,369. This price puts the machine at the lower end of the cost curve compared with the other machines in this roundup. A stripped-down configuration with only 1MB of RAM, 32K of processor RAM cache, a 40MB IDE hard disk, and a Hercules monochrome monitor would cost just \$2,279—less than or equal to the amount you might pay for some similarly configured 286-based PCs.

PC Brand has not neglected design considerations to bring you this lower price. The front of the computer now has a decidedly modern look with its round, off-white push buttons for the power, reset, and turbo switches. The positions of these buttons have been changed since the last time the machine was reviewed, most importantly that of the reset button. It is now more in

the middle in a square, indented button area in the middle of the unit so it's less likely to be accidentally activated.

The case measures 6.5 by 18.9 by 15.9 inches. In spite of its rather svelte width and depth, it manages to house six half-height drive bays that could hold a maximum of two full-height disk drives. Four of the bays are accessible through the face plate. Two of the drive bays can hold only a 3.5-inch drive, which means you have to plan how you will use them. The model we tested came with a Mitsumi 1.44MB floppy disk drive in one of these 3.5-inch bays.

PC Brand is able to fit everything into a smaller space because the 386/33's new motherboard, which is manufactured by Micronics—as was the one in the first 33-MHz 386—is the size of the one in an IBM AT. The DVE power supply it uses is also small. By shrinking the insides, PC Brand has been able to produce slim-line and minitower case options for the first time with this version of the computer.

Although the Cache Desktop has a smaller footprint, it isn't cramped on the inside. Again, this reflects PC Brand's attention to design. There's a nice amount of space between the back of the drive bays and the power supply for the drive cables, and it's easy to get at all eight expansion slots. The case is reinforced by a bar run-



PC Brand 386/33 Cache Desktop, \$3,369.

ning front to back along the top left side. This is where the machine is most vulnerable because the add-on slots are here.

Since the motherboard is small, the drive bays don't hang over it and all the chips, circuitry, and sockets are easily accessible. The main chip set has four pieces, replacing what used to be about 33 discrete parts. The smaller number of chips means less heat and less power consumption, which should improve the life span of the Cache Desktop.

Another important change in this moth-



Flash 386-33

National Micro Systems
Inc., 2833 Peterson Pl., Norcross, GA 30071;
(800) 642-7649.

List Price: With 4MB RAM, 1.2MB or 1.44MB floppy disk drive, Hercules monochrome display subsystem, one parallel and two serial ports, \$2,149; with 150MB hard disk, 64K RAM cache, Super VGA multiscanning display subsystem, DOS 3.3 or 4.01, \$3,199.

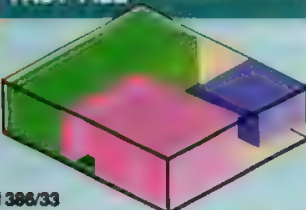
In Short: This computer lives up to its name, with speedy system performance on our benchmark tests. The Flash 386-33 is ideal as a file server—particularly in a Unix network—because you can install up to 64MB RAM right on the motherboard. Its exceptionally low price makes this a PC that should top anyone's list of "possibles."

CIRCLE 634 ON READER SERVICE CARD

erboard is its ability to hold up to 4MB of RAM with 80-ns. SIMMs. In the earlier version of the Cache Desktop all the memory went on an add-on board. Now, if you don't need more than 4MB of RAM, you save one expansion slot. Having the memory on the motherboard also makes the Cache Desktop a bit faster.

In fact, the current model outperformed the earlier version on every benchmark test—except for the one involving DOS file access with large records. Another reason for the improved performance is the use of a Seagate IDE hard disk, with an average access time of 15 milliseconds. The Cache Desktop placed in the top third of the review group for processor and memory speed and somewhere in the middle for hard disk and video operation.

If you want a superfast computer, the PC Brand Cache Desktop is not your machine. If price is more of a consideration, however, this machine gives you a good one with good performance. And the Cache Desktop is backed by a very nice warranty. PC Brand gives you a full year of free parts and labor. For the first 90 days you get on-site service, which can be continued for the rest of the year for only \$50.



FACT FILE

**PC Brand 386/33
Cache Desktop**
PC Brand Inc., 954 W. Washington St., Chicago, IL 60607; (800) 722-7263.

List Price: With 1MB RAM, 32K RAM cache, 40MB hard disk, 1.2MB or 1.44MB floppy disk drive, Hercules monochrome display subsystem, one parallel and two serial ports, QA Plus, Setsys, \$2,279; with 4MB RAM, 64K RAM cache, 143MB hard disk, 1,024-by-768 color display subsystem, DOS 4.01, \$3,369; with both floppy disk drives, \$3,444.

In Short: The PC Brand 386/33 Cache Desktop is a good, solid machine with attractive exterior design and six half-height drive bays inside. You can configure it for up to 16MB of RAM and select bus speeds from 8.3 to 11 MHz. With its competitive price and excellent warranty arrangement, this is a fine machine for power users.

CIRCLE 635 ON READER SERVICE CARD

After the first year, PC Brand's warranty covers the motherboard, power supply and option cards purchased with the machine on a pro-rated basis: 80 percent for the second year, 60 percent for the third year, and so on through the fifth year. This warranty

shows the faith PC Brand has in its computers. It's a faith supported by a solid product that is capable of serving you well.

PC CRAFT INC.

PC Craft 2401/33

by Henry Fersko-Weiss

In the past year PC Craft has apparently concentrated on reducing the hefty price of its first 386 33-MHz computer, the 5000/33C. The company now manufactures its own motherboard, which it houses in the new PC Craft 2401/33, a model that sells for less than 50 percent of its predecessor's cost, even with a larger hard disk installed.

While the computer has been knocked down from its lofty \$12,000 plateau, it's still not a bargain at \$5,268 for the standard configuration with 4MB of RAM, a 150MB ESDI hard disk, a TEAC 1.2MB floppy disk drive, and PC Craft's own 1,024-by-768 color monitor. The model we tested included a 203MB SCSI hard disk and added a Cyrix coprocessor, a \$320 option that bumps the system price up to \$5,790.

Unfortunately, the reduced cost brings with it not only less RAM and cache, but reduced performance as well. The performance of the 2401/33 places it in the middle or lower third of our review group, depending on the test, but its high price puts it in the upper third.

Like the first-generation model, the 2401/33 comes in a tower case, but, at 24 by 6.8 by 16 inches, it is ever so slightly smaller. The power, reset, and turbo switches are conveniently located on a protruding, tilted panel about midway down the front of the machine. All six of the half-height drive bays can open onto the front, giving you very good access. In the back there are four 25-pin cutouts and three 9-pin cutouts for device connectors.

On opening the computer, you find that the drive bays and a fairly large power supply take up the top half of the box. The motherboard fills up much of the lower half. There are eight expansion slots in the 2401/33, the same amount as in the earlier model 5000. But now there is only one proprietary 32-bit slot, where there were three before. Since all the system memory goes on the add-on card, the 2401/33 is

limited to 16MB, while the 5000 could support up to 32MB. DOS won't allow for more than 16MB now, so the current limit isn't a problem for most applications. And the smaller number of 32-bit slots is actually an advantage since that makes for two additional, all-purpose 16-bit slots.

The new, half-size 2401/33 motherboard evidently costs less but also supports a smaller amount of total RAM and less processor RAM cache than did the original full-size motherboard from Mylex. The new motherboard uses a Chips and Technologies chip set and an interleaved memory arrangement, which is the same as on



PC Craft 2401/33, \$5,790.

the earlier Mylex motherboard. But the 2401/33 uses the Intel 82385 processor RAM cache controller instead of discrete logic. The Mylex motherboard came with 128K of RAM cache, while the PC Craft motherboard has only 32K, less than the amount offered by most of its peers. In defense of this drop in capacity, PC Craft says it gets a 98 percent cache hit ratio with 32K, and going as high as 256K increases the ratio by a mere half of a percentage point.

A very favorable difference between the current motherboard and the Mylex board is the setup procedure. The Mylex board was a forest of 60 or so jumpers. With the PC Craft motherboard most of the setup is done through software in ROM—including switching between zero and one wait states and disabling the video or system BIOS shadowing. This approach is much easier and safer than fiddling with jumpers.

PC Craft offers the usual one-year warranty on parts and labor. During the first four months of this period you get on-site



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—Daniel Morgan, PC Magazine, 9/25/90



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—PC Sources, Nov. 1990



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—PC Magazine 9/25/90

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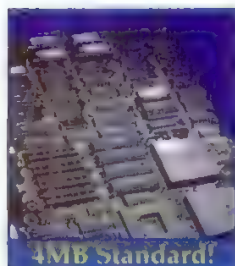
— Computer Shopper, October 1990

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w/200MB (16ms) IDE	\$5245	\$5295	\$5445	\$5645
w/330MB (16.5ms) SCSI	\$6545	\$6595	\$6745	\$6945
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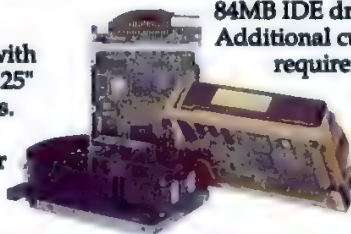
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Swan 386/25C



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- 84MB 19ms IDE drive
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- Dual high-density floppy drives
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— Computer Buyer's Guide & Handbook

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Drive Options				
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w/84MB (19ms) IDE	\$1645	\$1695	\$1845	\$2045
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Drive Options				
w/42MB (19ms) IDE	\$1795	\$1845	\$1995	\$2195
w/84MB (19ms) IDE	\$2045	\$2095	\$2245	\$2445
w/200MB (16ms) IDE	\$2545	\$2595	\$2745	\$2945

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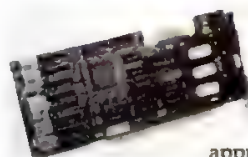
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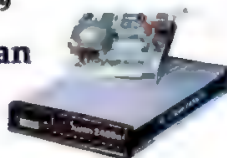
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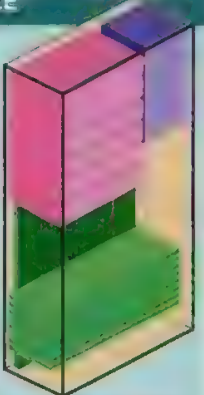
\$925

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service. You can buy an extension of this service to cover the whole year, but it costs a whopping 11 percent of your original purchase price. If you buy the 2401/33 from one of PC Craft's specially authorized Gold or Red VARs you get a full year of on-site service free.

FACT FILE

PC Craft 2401/33
 PC Craft Inc., 640
 Puente St., Brea,
 CA 92621; (714)
 256-5000.
List Price: With
 4MB RAM, 110MB
 hard disk, 1 2MB or
 1.44MB floppy disk
 drive, Hercules
 monochrome
 display, one parallel
 and two serial ports,
 PC Test, \$4,040;
 with 150MB hard disk, 1,024-by-768 color display
 subsystem, DOS 4.01, \$5,268; with 203MB hard
 disk, math coprocessor, \$5,790.
In Short: By manufacturing its own half-size
 motherboard and cutting down on the amount of
 processor RAM cache, PC Craft has reduced the
 cost of its 33-MHz 386 by more than 50 percent.
 But it's still a pricey machine when you consider
 its average to below-average scores on our
 benchmark tests and the relatively standard
 features.



CIRCLE 636 ON READER SERVICE CARD

The 2401/33 is much more competitively priced than was the first-generation model from PC Craft, and the machine has some nice features. But it's hard to justify buying a PC of average performance with an above-average price tag.

POLYWELL COMPUTERS INC.

Poly 386-33PT

by Henry Fersko-Weiss

The Poly 386-33PT is a completely new 33-MHz computer—from the inside out. Polywell Computers has designed its own motherboard and put it in a distinctive, intelligently fashioned case. These changes make for a more flexible and better-performing machine that is 30 percent less expensive than its predecessor.

In our standard configuration, with 4MB of RAM, a 64K processor RAM cache, a 158MB ESDI hard disk, a 1.2MB or 1.44MB floppy disk drive, a Diamond Computer Systems 16-bit video adapter and Matsushita ViewSonic 4 1,024-by-768 Super VGA color monitor, one paral-

COMPUTERS

33-MHz 386 PCs

lel and two serial ports, and DOS 4.01, it lists for \$4,550. The machine contains quite a few new components, including the new Polywell motherboard that replaces the Mylex board used in its original 33-MHz 386, the inconsistently performing Polysystem 33 Cache we called "a somewhat flawed system."

The new motherboard holds all the system memory—up to 32MB with 4MB SIMMs. This arrangement saves a slot and should improve the system throughput. In our tests, however, there was only a minimal increase in overall computer performance as measured by the 80386 Instruction Mix benchmark test; this Polywell is just 2 percent faster than its predecessor. And the Conventional Memory performance was about 22 percent slower. But the board is bound to be more dependable because it's much more cleanly laid out. The Mylex board had about 20 traces on it, where the Polywell board has none, and fewer jumpers as well.

The new Poly 386-33PT did much better on the hard disk and video benchmark tests. In fact it had the best Direct to Screen test time of all the computers reviewed. These results were undoubtedly because of its 14-millisecond Maxtor hard disk with a 32K buffer, and its Diamond Computer Systems 16-bit video adapter with 1MB of memory.

A couple of other changes to the motherboard are worth noting. It has eight layers, rather than the more common four or six layers. This reduces the frequency noise that could shorten the life of the board. An unusual feature on the motherboard is a digital LED light that can display codes for 42 different operations. These codes can tell you what the computer is doing at any given moment—for example, testing memory, reading the floppy disk drive, accessing the hard disk, and so on. By reading the LED you can help a technician analyze a problem.

BUILT TO MOVE

Polywell also improved the tower case that enclosed its first 33-MHz 386. Standing a full 25 by 8.8 by 20.3 inches, the Poly 386-33PT's case is larger than the usual tower case (the company does offer a differently designed standard tower version of the 386-33PT for \$150 less) and is quite distinctive-looking. Painted a gun-metal gray, it has wheels on the bottom front and a retractable pull-handle at the top of the

back panel. It's very easy to pull the machine around, which makes it ideal for engineering applications where machines are frequently moved.

The front of the Poly 386-33PT has a pop-open door that covers the power, reset, and turbo switches as well as the five accessible half-height drive bays. The top



Poly 386-33PT, \$4,550.

of the door has tinted see-through plastic that lets you read the LED lights while protecting the machine from being accidentally reset.

The thoughtfulness of the case design is evident everywhere. You open the case by unscrewing just three screws that release a hinged side panel. Keeping the side panel attached cuts down on the possibility of damaging it when the machine is open. And there is a case lock in the back to secure the system. Right across the middle, inside, there is a hinged, shock-resistant plate for attaching a full-height disk drive. This plate is screwed to the back of the computer. When you swing it open you get comfortable access to the upper part of the motherboard. The eight expansion slots are below the plate, so you don't have to bother unscrewing it when inserting or removing boards.

The computer's power supply has a 250-watt capacity, and there are two cooling fans and ample space to keep the computer from getting too hot. A second shock-resistant full-height drive bay sits just below the half-height drives in front. In the model we tested, it held a Maxtor 158MB ESDI hard disk. The top two half-height bays had a 1.2MB and a 1.44MB TEAC floppy disk drive, respectively.

The warranty on the Poly 386-33PT is excellent. You get two years on the moth-

33-MHz 386 PCs

erboard and graphics card; one year on all other parts, and five years on labor. For an additional \$75, you can buy on-site service with Repair Technology International.

With its big RAM capacity, large num-

than last year's offering, it is hardly "hundreds of dollars less than comparable machines," as it was last year. Perhaps this is the result of moving to an Everex motherboard from one the company manufactured itself, and the greater devotion to quality in the case.

Certainly, design and attention to structural strength make Spear's new desktop case a model of sturdiness. It has a support bar screwed on along the left side, well-engineered contacts, and highly tolerant metal for the body.

The case has also changed in appearance. In addition to the decorative stucco-like finish added to its cream-colored face, the three drive bays accessible through the machine's front now have a sliding plastic cover to keep out dust. It has a total of five half-height drive bays, compared with the older Spear 33-MHz machine's three. A hinged door on the left side of the faceplate pulls open to reveal a reset and speaker on/off switch. The machine's speaker switch is a thoughtful touch, and the door keeps you from inadvertently hitting the reset switch.



Spear Ultra 386/33, \$4,410

The Ultra's Everex motherboard uses discrete logic instead of a system chip set. It also uses discrete logic to control the processor RAM cache now, rather than an Intel 82385 controller. The discrete logic may slow the system somewhat, but that is counter-balanced by having the 4MB of RAM on the motherboard rather than on an add-on card. Since you can put up to 8MB of RAM on the motherboard, you also save a slot. The Ultra has five free slots after it is configured like our test machine; the previous model had only four free slots. Another positive change comes from using the faster write-back memory

scheme, rather than the write-through scheme used in the previous model.

The Ultra did well enough on PC Magazine Labs' 80386 Instruction Mix, Float-

FACT FILE

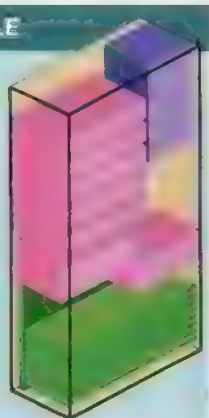
**Poly 386-33PT**

Polywell Computers Inc., 61-C Airport Blvd., South San Francisco, CA 94080; (800) 999-1278.

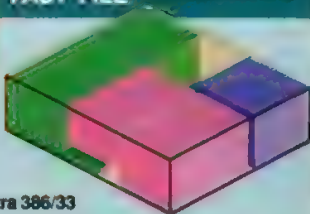
List Price: With 4MB RAM, 1.2MB or 1.44MB floppy disk drive, Hercules monochrome display subsystem, one parallel and two serial ports, \$2,275; with 158MB hard disk, 1,024-by-768 color display subsystem, DOS 4.01, \$4,550.

In Short: The Poly 386-33PT is a distinctive tower computer with wheels on the bottom front and a pull handle on the back for easy transport. It supports five half-height and two full-height disk drives, can hold up to 32MB on the motherboard, and has a generous warranty.

CIRCLE 637 ON READER SERVICE CARD



FACT FILE

**Spear Ultra 386/33**

Spear Technology Inc., 710A Landwehr Rd., Northbrook, IL 60062; (800) 852-4202.

List Price: With 1MB RAM, 1.2MB or 1.44MB floppy disk drive, Hercules monochrome display subsystem, one parallel and two serial ports, \$2,555; with 4MB RAM, 141MB hard disk, Super VGA color display subsystem, DOS 4.01, \$4,410.

In Short: Previous Spear computers have offered solid performance at cheap prices. This Ultra 386/33 has fallen out of the mold. While some of its benchmark test scores have improved, others have worsened, and its price has not dropped enough to be considered low. The one area of marked improvement is in the sturdiness of the case and its design.

CIRCLE 638 ON READER SERVICE CARD

ber of drive bays, and very good video benchmark test scores, the Poly 386-33PT would make an excellent graphics or CAD workstation. Only its average system speed keeps it from being a winner across the board, but its impressive price and warranty should earn it honors. Certainly it's a vast improvement over its inconsistent predecessor.

SPEAR TECHNOLOGY INC.

Spear Ultra 386/33

by Henry Fersko-Weiss

The Spear Ultra 386/33 sports a new, faster motherboard and a sturdier, more appealing case than the previous model. But in other areas performance has weakened. Though arguably a better machine overall, it is no longer one of the least expensive on the market, and therefore has lost its original *raison d'être*.

In our standard configuration, with 4MB of RAM, a 64K processor RAM cache, a Toshiba 141MB ESDI hard disk, a TEAC 1.2MB floppy disk drive, an NEC MultiSync 3D monitor, and DOS 4.01, the Spear Ultra 386/33 costs \$4,410. While not a terrible price, and somewhat lower

ing-Point Calculation, and Conventional Memory tests. These results place it comfortably in the top half of the computers we reviewed. The Ultra did not fare as well when it came to the hard disk and video benchmark tests. The hard disk results were among the worst in the group. The Ultra's BIOS Disk Seek time made it dead last. Part of the blame has to go to the Toshiba hard disk, which has a relatively slow average access time of 24.5 milliseconds. The buffer on this drive is only 16K. The video benchmark test results were only a little better.

The warranty on the Ultra is the typical one-year for parts and labor. If the computer breaks down you have to ship it back to Spear, unless the problem can be diagnosed over the phone and you're capable of replacing a malfunctioning part. On-site service is available through IAI for \$75 per year.

Although Spear is not a household name, it has been making good meat-and-potato PCs for five years and has competed in the past on price. The performance of its current 386 33-MHz PC varies considerably when it's stacked up against the competition, and its price is no better than average. You can certainly do better, although the haute appearance of the Spear Ultra 386/33 and its very strong case are undeniably appealing.



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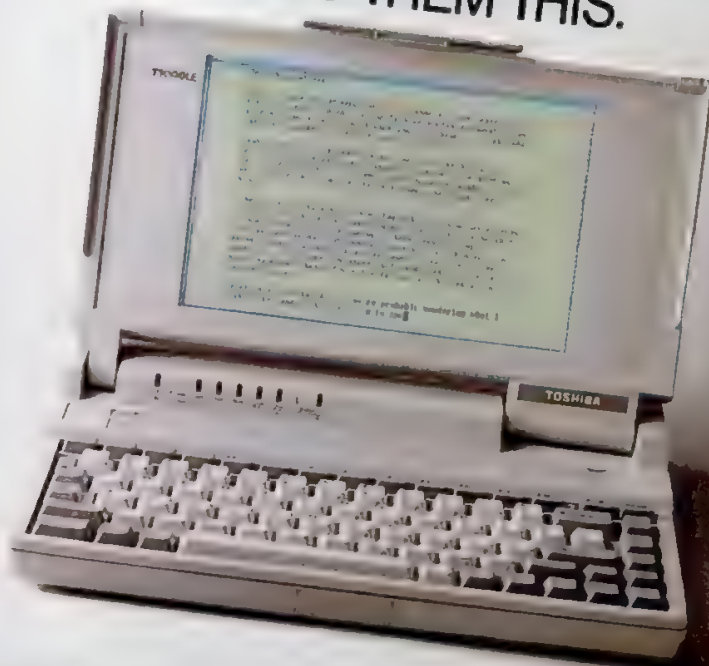
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CIRCLE 169 ON READER SERVICE CARD

TANDY CORP.

Tandy 4033 LX

by Bill O'Brien

It may not be the first computer company name that springs to mind when the topic of microcomputers is broached, but Tandy, with its plethora of service-oriented retail outlets, is one of the big three microcomputer sellers. As the sort of offering we expect from a prime contender, the company's new 4033 LX should serve to remind us of Tandy's position; certainly the system comes at a premium aptly suited to an offering from one of the big three.

This system's \$8,716.75 price tag buys you 4MB of RAM, a 168MB hard disk, a 32K processor RAM cache, a 1.44MB floppy disk drive, a VGA display subsystem, and DOS 4.01, all neatly packaged in a small-footprint enclosure. The chassis also has room for two 3.5-inch drives with front-panel access and either a full-height or twin half-height drives inside, as well as one parallel and two serial ports. The machine's 200-watt power supply should prove adequate for the relatively low device count.

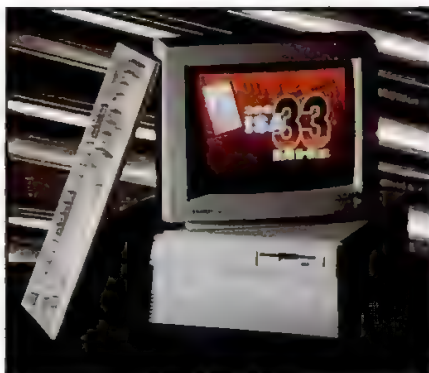
The system contains no motherboard. It uses an active backplane, but it's not quite as active as some because it doesn't contain the system RAM. The backplane provides floppy disk drive, keyboard, mouse, and I/O connections, but the heart of the system is a processor card that also carries 32K of 20-nanosecond processor RAM cache—less than the 64K found in most of the other machines reviewed in this issue, though not necessarily a performance detriment because no one can actually agree on what hit rates are available consistently at any given level—managed by an Intel 82385 cache RAM controller. A Chips and Technologies 80386 chip set keeps the processor in line, and Tandy employs a Phoenix BIOS in the computer. System RAM occupies either of two proprietary slots on the backplane and a total of 16MB is usable by the LX.

This is one of the more high-tech machines reviewed, though the system does pay a small penalty for its slot-mounted processor and RAM, even though they are in proprietary slots. PC Magazine Labs' processor and memory benchmark tests peg the 4033 LX as one of the slower systems in the group, but the difference is so slight that it wouldn't be noticed under the majority of applications you would run.

COMPUTERS

33-MHz 386 PCs

The system's hard disk is a Seagate 168MB drive connected to an Adaptec SCSI controller. It's rated at 19 milliseconds and proved competent, while not superlative, on the hard disk benchmark tests. Tandy's choice of video is a VGA card with a Paradise chip set that is also not a marvel of speed. Our video benchmark



Tandy 4033 LX, \$8,716.75.

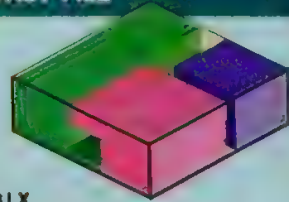
tests give it a "thumbs up" for BIOS operations, but this is definitely not a card that you'd want to use if your application is writing directly to the hardware. (Of course, this is something you shouldn't be doing anyway.)

Tandy literally wrote the book on computer documentation; that is, David Lien did, for the original Model I. While the company has migrated away from the heavy use of anthropomorphic computer monitor illustrations, the owner manual for the 4033 LX embodies the same spirit. First and foremost, it is in English, and, in places, even colloquial English. And it is informative. The manual is more concerned with teaching you how to use the computer than how to upgrade it, however, because Tandy would rather have you use Radio Shack to modify your system.

Service and support are Tandy's main selling points. Before you buy a system, many Radio Shack Computer Stores allow you to try it out, with the software you'll be using. If the 4033 LX should break, it's covered for a full year on all parts and labor with the warranty implemented through your dealer. For many systems that would mean repacking and shipping, but unless you live somewhere in the Australian outback, it's likely that you have a Radio Shack store nearby. If need be, Tandy will sell you an on-site service contract: The cost depends on the actual configuration of the system you want covered.



FACT FILE



Tandy 4033 LX

Tandy Corp., 1800 One Tandy Center, Fort Worth, TX 76102; (817) 390-3011.

List Price: With 2MB RAM, 80MB hard disk, 1.44MB floppy disk drive, VGA video adapter and VGM-200 monitor, one parallel and two serial ports, mouse port, \$6,497.95; with 4MB RAM, 168MB hard disk, VGM-300 monitor, DOS 4.01, \$8,716.75.

In Short: Tandy has scored another winner with the 4033 LX, but mail-order buyers are not going to be impressed by the steep price the system commands.

CIRCLE 639 ON READER SERVICE CARD

With an FCC Class B rating and a small footprint case, the Tandy 4033 LX's only drawback is its relatively high price compared with mail-order systems. Tandy is counting on its premium added value to offset the premium pricing. If you need the high level of support the company offers, the money is well spent.

TANGENT COMPUTER INC.

Tangent 333c

by Bill O'Brien

You won't buy a Tangent 333c for beauty, but the new version of this computer might well inspire love, especially if you're thrifty. Tangent has done its homework and vastly improved the 333c from the last version PC Magazine reviewed.

If you take a cursory glance at a Tangent 333c, you might mistake it for an old AT. But don't let the desktop box fool you. Inside is a 33-MHz 80386 motherboard with 4MB of RAM. A 150MB hard disk and an Orchid ProDesigner II video card—which you'd hardly expect to find in an AT—are standard fare for the 333c. About the only thing the 333c might have in common with the computers it superficially resembles is its low price: \$3,784 buys you 4MB of RAM, a 160MB hard disk, a 1.2MB floppy disk drive, a Super VGA subsystem with a 14-inch monitor, one parallel and two serial ports, and DOS 4.01.

The Tangent 333c's chassis is pure AT design with a 220-watt power supply



Tangent 333c, \$3,784.

thrown in to handle the heftier hard disks, larger amounts of memory, and expansion boards currently available on the market. Three half-height bays have front panel access, while two hide beneath the front panel; the latter were filled by a single full-height hard disk in the reviewed machine. The only adornments on the Spartan exterior are round turbo and reset buttons although Tangent might be well advised to better distinguish between the two to avoid accidental resets.

The Tangent 333c's eight-slot motherboard is pretty much standard fare. Manufactured by Artronics, it uses discrete logic in place of a large-scale integrated circuit 80386 chip set and mounts a discrete TTL (Transistor-to-Transistor Logic) array to manage the cache RAM in place of a single dedicated controller. The board came with 64K of 35-nanosecond SRAMs doing cache chores; they were linked to 4MB of 70-ns. system RAM out of a possible 8MB motherboard maximum. Expansion to the system's 16MB limit is accomplished through a proprietary memory slot that does double duty as one of the board's six 16-bit slots.

The physical placement of the motherboard memory deserves some attention. The most typical location for SIMM slots is at the front of the motherboard, positioning that can allow full-length I/O boards inserted into one of the system's slots to come into contact with installed SIMMs. To avoid this possible conflict, Artronics has mounted a SIMM slot right next to each I/O slot.

Normally, this will not pose a problem, but the height of the SIMM module is such that if you try to insert an I/O board that doesn't have at least three-eighths of an inch of clearance above its edge connector, you will contact the SIMM module. Adaptec's SCSI controller card and some para-

COMPUTERS 33-MHz 386 PCs

llel/serial cards immediately come to mind as possible problems, though the vast majority of boards would work perfectly well in this setup. Tangent says that it will be switching over to a lower-profile SIMM that should eliminate any chance of a conflict.

Tangent packed a 150MB Imprimis hard disk into the 333c and connected it to an UltraStor ESDI controller with a 32K buffer. Though the PC Magazine Labs disk test's mixture of read and write routines easily exceeded the capacity of the

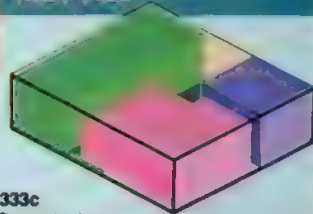
For \$79 Tangent offers
you an on-site service
contract during the
warranty period so
you'll never need to
put your hands on
anything but the
keyboard.

buffer, the drive did quite well. There's no substitute for quality, and that holds true for the video, as well. Orchid's ProDesigner II is one of the faster video cards currently marketed, and it has found a good home in the 333c. While the Mag Computronics label of the 13-inch monitor may not be as familiar as others, the combination of the two give you 1,024-by-768 resolution in exquisite detail.

Graphic artists will appreciate the cover artwork on Tangent's new documentation, while gearheads will be pleased by its collection of hardware information. There's even enough plain English in the manual to get a novice up and running in no time flat. If you do encounter a problem, Tangent offers phone support to help you surmount it. And the company backs its equipment fully for one year, so it can cure even hardware failures by sending out a new part. If your computer frightens you, \$79 buys you an on-site service contract during the warranty period so you'll never need to put your hands on anything but the keyboard.



FACT FILE



Tangent 333c

Tangent Computer Inc.,
197 Airport Blvd., Burlingame, CA 94010; (415)
342-9388.

List Price: With 33-MHz 80386, 1MB RAM, 1.2MB floppy disk drive, one parallel and two serial ports, game port, monochrome display subsystem, \$1,745; with 4MB RAM, 150MB hard disk, Super VGA display subsystem, DOS 4.01, \$3,784.

In Short: The 333c has undergone a major revision since it was last reviewed, and it now offers performance commensurate with an 80386 environment at a very low price.

CIRCLE 640 ON READER SERVICE CARD

The computer tested is one of only a handful that have received FCC Class B certification. Though the rating is not mandatory for 486s in a business setting, it does allow the 333C to become a low-cost, high-performance system for your home office.

TRI-STAR COMPUTERS CORP.

Tri-Star 386/33

by Bill O'Brien

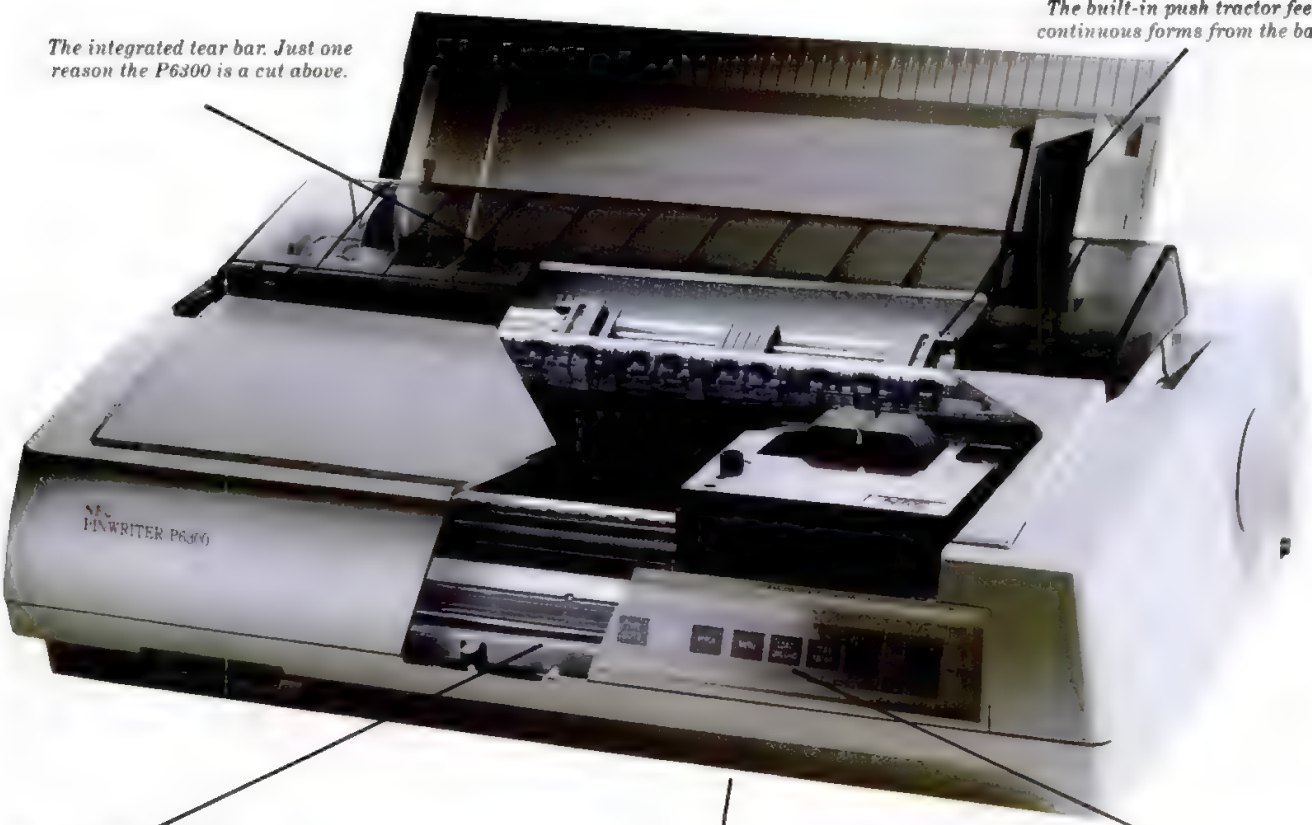
The Tri-Star 386/33's return to *PC Magazine* is sparked by its change of a motherboard and BIOS. If the new 386/33 doesn't knock you over with its price, it has enough performance and service marks to get it a serious second look.

The standard Tri-Star 386/33 system comes with 4MB of RAM, a 64K RAM cache, a 200MB hard disk, 1.2MB and 1.44MB floppy disk drives, and a Super VGA display subsystem wrapped in a tower enclosure for a competitive \$3,564—one of the lowest prices you'll find for what is really a power computer. Tri-Star sent along a Nanao 16-inch Flexscan monitor with an STB EM-16 video board with the system we reviewed, which bumped that price up to \$4,455. The resulting big-screen video heaven is well worth the upgrade cost. But if you're in a budget crisis and you're willing to settle for just 1MB of RAM, Hercules-compatible graphics, and

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the beauty of the P6300 (and its narrow-carriage brother, the P6200) extends beyond the printed page. Because they give you the ability to print on everything from 24-pound letter-head and envelopes, to continuous forms, labels, and card stock. Plus the ease to go from one to another, from one minute to the next.

It takes guts to say the Pinwriter P6300 is the best dot-matrix printer you can buy today.

It takes a lot less than you think to bask in its glory.

NEC



*Color kit sold separately.

NEC Technologies, Inc. 1414 Massachusetts Ave., Boxborough, MA 01719. 1-800-NEC-INFO. In Canada, 1-800-343-4418.
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CC Company and Communications

COMPUTERS
33-MHz 386 PCs

a monochrome monitor, you can get what's otherwise the same system for just \$3,045.

The tower case housing the Tri-Star 386/33 hasn't changed since we reviewed the system ("High-rise Computing: 22 Powerhouse PCs Top Off at 33 MHz," *PC Magazine*, October 31, 1989). It's still slightly larger than some, at 25.5 by 8 by 18 inches. There's room for six half-height

drives and possibly a small aquarium inside. The motherboard barely occupies half of the interior real estate and the 220-watt power supply is easily in another area code. It is an exercise in sheer excess and a

Like many of the systems reviewed, the Tri-Star's TPE motherboard relies heavily on discrete components.

perfect way to impress someone who doesn't understand the innate power behind the technology of a 33-MHz 80386 computer and assumes bigger is necessarily better.

Tri-Star claims parenthood for the 8-slot motherboard in its 386/33 system, but packed in with the documentation was a separate spiral-bound booklet from Technology Power Enterprises of Fremont, California, which claims to have actually designed and built the board. (Like a lot of clone makers, Tri-Star seems to think of itself as a surrogate parent of the board because it actually takes over warranty responsibility.) Like many of the systems reviewed, the TPE board relies heavily on discrete components, with the AMI BIOS excepted. TTLs comprise the 80386 managing chip set and also perform cache-controlling duties for the 64K of 20-nanosecond SRAMs, which can be expanded to 256K for what might or might not provide a better hit ratio.

The motherboard can hold up to 8MB of 1MB SIMMs, with further expansion to the system's 16MB maximum done through the single 32-bit proprietary slot. As configured, with 4MB of 80-ns. SIMMs, the board came through PC Magazine Labs' suite of processor and memory tests without embarrassment. It ranks easily among the top half of the computers tested and does so without the assistance of



Tri-Star 386/33, \$4,455.

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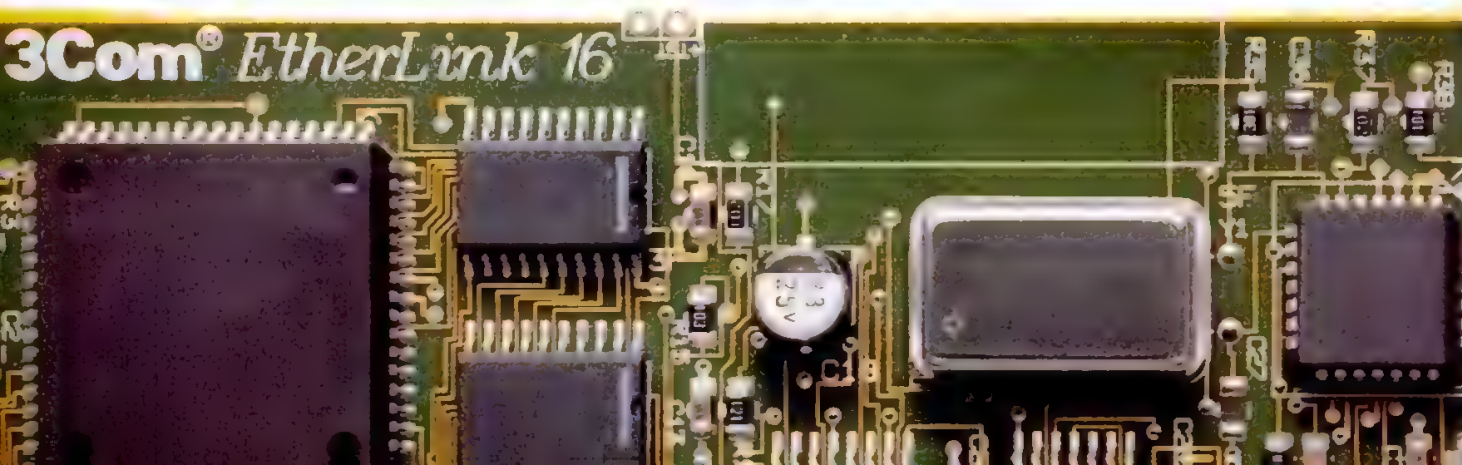
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COMPUTERS

33-MHz 386 PCs



FACT FILE

Tri-Star 386/33

Tri-Star Computers
Corp., 707 W. Geneva
Dr., Tempe, AZ
85282; (800) 678-
2799.

List Price: With 1MB
RAM, 200MB hard
disk, 1.2MB and
1.44MB floppy disk
drives, one parallel
and two serial ports,
game port,
monochrome display
subsystem, \$3,045;
with Super VGA display subsystem, DOS 4.01,
\$3,564; with 16-inch monitor, \$4,455.

In Short: The Tri-Star 386/33 has a winning
combination of solid performance, extended
service, and low price that should spark a buying
frenzy.



CIRCLE 841 ON READER SERVICE CARD

hard disks is becoming standard fare among a large number of mail-order vendors. The "A" designation here indicates that it's a no-frills, embedded-AT-type hard disk, using an interface scheme much

Tri-Star's warranties
are double those of
most mail-order
houses: two years for
parts and labor and a
60-day return period.

system BIOS shadowing, which is not implemented.

This system comes with a 15-millisecond Maxtor LXT-200A IDE hard disk. Maxtor's line of 3.5-inch large-capacity

like the one you'd find in your old AT. Despite what may seem a handicap, the hard disk managed to acquit itself admirably on our hard disk tests.

Tri-Star's video card of choice was the

STB EM-16, the same card that can be found in Zodiac's 333. Fortunately, the card appears to work in the Tri-Star. It does so without video BIOS shadowing, which is also not implemented on the TPE motherboard. While it certainly will not dazzle you with its speed in scrolling operations, the card runs fast enough through the remaining video benchmark tests to be a desirable component in the 386/33. In the standard system you'll be downgraded slightly to a Western Digital VGA board.

Documentation—often the mail-order computer buyer's chief source of woe—is what you'd expect. Like many other vendors, Tri-Star has compiled a collection of peripheral documentation that, while complete in many ways, provides none of the hand-holding that the novice might require. But Tri-Star also provides a toll-free support line for those times when the system may seem overpowering.

For hardware problems, Tri-Star's warranties last twice as long as those from most mail-order houses. Its parts-and-labor coverage lasts for two years, and its return period extends for 60 days. Service is carried out over the phone, with parts shipped as needed. As has become stan-

board available. ch up to its warranty.

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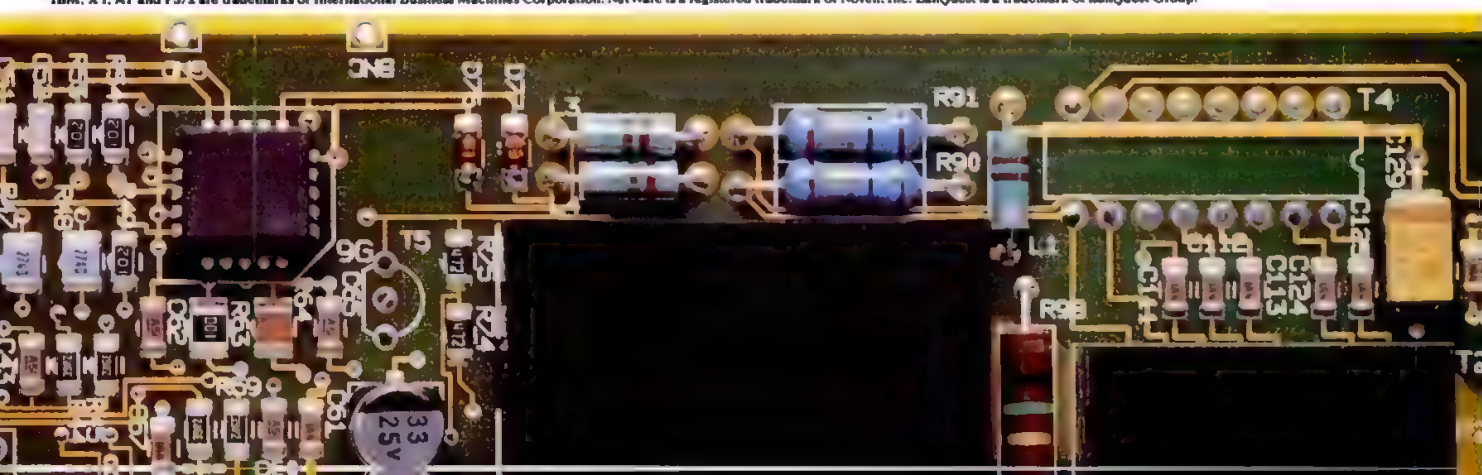
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COMPUTERS

33-MHz 386 PCs

dard, on-site service, from TRW in this case, is available in case a problem seems unsolvable through normal channels.

Because of its FCC Class A rating, the Tri-Star 386/33 can find its way only into your office. Tri-Star's pricing and extended service policy could be the edge that puts it there, and if it does, you probably won't need to worry about the money-back guarantee.

ZEOS INTERNATIONAL LTD.

Zeos 386-33

by Bill O'Brien

Zeos is cutting a swath through the ranks of mail-order computer sellers, and the company is honing its sword with the 386-33. By offering a system with 4MB of RAM, a 160MB hard disk, two high-density floppy disk drives, and a Super VGA display subsystem, not to mention DOS 4.01, *Microsoft Windows* and a mouse, for \$4,470, Zeos is certainly making a point. In price alone, this machine has improved by more than 25 percent over its predecessor, and it is considerably better stocked as well.

A tower houses Zeos's FCC Class B-rated computer. It encloses six half-height drive bays, and a little 3.5-inch bay

base, behind the front panel.

Replacing the AMI motherboard of last year's machine is a new Mylex design that has some interesting features. Standard equipment, like before, includes an impressive eight slots. Two of these slots stretch out into the proprietary configuration that's become common for add-in 32-bit memory boards, which can also house standard 8-bit cards. Zeos points out that the system will handle 32MB of memory, however, without requiring a slot to be touched: The company says the mother-

PC Labs' 80386
Instruction Mix,
Floating Point
Calculation, and
Conventional Memory
tests rank the Zeos
386-33 among the top
three machines.

board is fully capable now of using 4MB memory SIMMs, so filling the eight SIMM banks is all that's needed to top off the system RAM. That, of course, assumes you can get yourself 4MB SIMMs. The machine that was reviewed contained 4MB of 1MB SIMMs rated at 80 nanoseconds.

The motherboard is powered by a Phoenix BIOS. Coprocessor compatibility extends to both the Intel 80387 and the Weitek 3167. The most striking feature of this motherboard is its high chip count. Discrete components do the work of what might otherwise be a large-scale integrated chip set and TTLs also manage the 128K of 25-ns. processor RAM cache. It's a winning combination for Zeos because our 80386 Instruction Mix, Floating Point Calculation, and Conventional Memory tests rank it among the top three machines—a far more impressive standing than its predecessor enjoyed. And that ranking holds even if you compare its scores with those of all the 33-MHz 80386 computers we've

ever tested.

An Imprimis 160MB hard disk linked to an Adaptec ESDI controller provides storage for the Zeos 386-33. The controller contains a 64K cache buffer. The full effect of the buffer is not readily evident from the computer's DOS File Access test scores, since the benchmark tests easily exceed the buffer capacity. Even so, the 16-millisecond drive is no slouch and ranks well among the top eight machines in this group.

Video chores are handled by a Diamond 16-bit Super VGA card and Zeos's own 14-inch 1,024-by-768-compatible monitor. As with many of the monitors currently billed at 14 inches, the figure accurately describes the diagonal tube size while the actual visible area of the screen is 13 inches. There are no complaints about the view from the screen; the quality of the graphic images and text characters is excellent. Ably assisted by video BIOS shadowing, the card managed a top-ten performance.

Zeos's documentation is a cut above the usual melange of assorted peripheral manuals. It includes hardware-specific documentation that fully describes all of the devices you've purchased, but doesn't neglect to provide a thorough user section that takes you from unpacking the box to modifying CMOS. The documentation is



Zeos 386-33, \$4,470.

hiding toward the back of the chassis (above the 250-watt power supply), which might almost go unnoticed. With seven expansion bays, the hefty power supply is a good choice. To keep down the heat, the tower also includes an auxiliary fan at its

FACT FILE

EDITOR'S CHOICE

Zeos 386-33

Zeos International
Ltd., 530 5th Ave. NW,
St. Paul, MN 55112;
(800) 423-5891.

List Price: With 1MB
RAM, 80MB hard disk,
1.2MB floppy disk
drive, Hercules
monochrome display
subsystem, one
parallel and two serial
ports, game port,
\$2,995; with 4MB
RAM, 160MB hard
disk, additional 1.2MB
or 1.44MB floppy disk
drive, VGA display
subsystem, DOS 4.01, *Microsoft Windows* 3.0,
Microsoft Mouse, \$4,470.

In Short: Success hasn't spoiled Zeos's outlook; its 386-33 has the right parts at the right price, with great performance. There's very little more you can ask for from a computer.



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 Volume 2 Number 13
 The Independent Comparative Ratings Report for Selecting IBM PC Business Software

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Software Digest Rating	Overall Evaluation	Overall Power	Program Name	Version Tested	Performance	Usability	Error Handling	Ease of Learning	Ease of Use	Memory Requirement	Price	Volume Purchase Agreement	Page
***	70	67	dBase IV	11	■	■	■	■	■	450KB	\$795	✓	28
**	6.8	51	Paradox	3.5	■	■	■	■	■	640KB	\$995	✓	32
**	6.8	71	FoxPro/LAN	102	■	■	■	■	■	512KB	\$1,095	✓	30
**	6.4	51	DataEase	4.2	■	■	■	■	■	640KB	\$750	✓	28
*	5.8	3.8	R:Base	3.0	■	■	■	■	■	520KB	\$995	✓	34
*	5.7	6.0	Clarion Professional Developer	21	■	■	■	■	■	512KB	\$845	✓	24
*	5.7	6.6	Advanced Revelation	2.01	■	■	■	■	■	640KB	\$995	✓	22

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In summation, their 75-page report says: "Among the top ranking programs, dBASE IV (version 1.1) is the most well rounded, with solid performance, versatility, and usability." Commenting on speed, Software Digest points out that "dBASE IV produces all three test reports as fast as or faster than FoxPro/LAN." As for Ease of Use/Ease of Learning, dBASE IV scored as many times in the Excellent range as any other database product tested.

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typeset, bound in a bookshelf-size ring binder, and the language is painless to read.

Painless also is Zeos International's sales policy. You have 30 days to evaluate the equipment before you really own it. Any time within that first 30 days you can call the company and send the machine back for a full refund. Zeos International pioneered the 24-hour phone support policy, and once you own the system you're no more than a phone call away from support or service for a full year (a whopping five-year warranty guards the keyboard). Parts failures are covered by a swap-out policy, and optional on-site service is available from TRW.

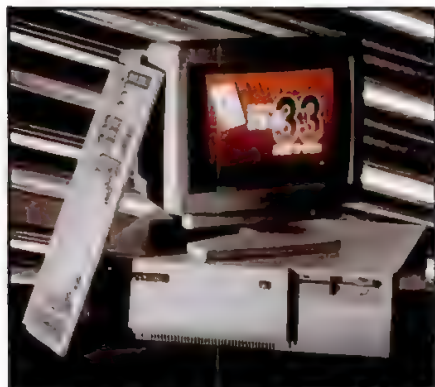
It's difficult to be more eloquent about the Zeos 386-33 than it already is about itself. Zeos International has taken brand-name components with credible performance levels, given them an attractive system price, and added in a customer confidence program that is nearly inspiring. The combination is as close to unbeatable as you can get.

ZODIAC TECHNOLOGIES

FiveStar 386/33

by Bill O'Brien

If Zodiac Technologies doesn't sound familiar, the name of its high-end offering should clue you in to the company's previous incarnation as FiveStar Computers. With a new motherboard and new BIOS



FiveStar 386/33, \$4,495.

chips, the FiveStar System 33/D has metamorphosed into the FiveStar 386/33. Along with a fresh coat of paint, the new computer carries a lower price (\$4,495 when equipped with 4MB RAM, a

COMPUTERS

33-MHz 386 PCs

150MB hard disk, and Super VGA video subsystem).

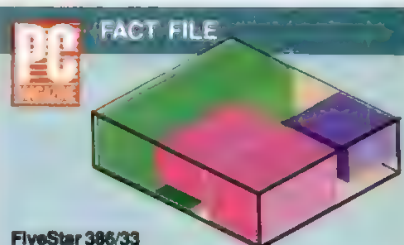
Like its predecessor, the Zodiac Technologies FiveStar 386/33 is typical. Its chassis is about as generic an AT style case as you'll find. A side-mounted power

With a new motherboard, new BIOS chips, a new paint job, and a lower price, the FiveStar system 33/D has metamorphosed into the Zodiac Technologies FiveStar 386/33.

switch, three front-accessible, half-height bays, and the usual complement of turbo and reset buttons are all too familiar. As with all such cases, two additional half-height bays are available internally and the chassis is equipped with a reasonable 200-watt power supply.

One peculiar feature of the chassis is the position in which its speaker is mounted. Instead of hiding it away in a corner somewhere, Zodiac has elected to mount the speaker horizontally over the leftmost pair of half-height drive bays. That may seem to be an innocuous enough position, but speakers—even the little two-inch speakers in a PC—use magnets to activate their voice coils. Magnetic fields are notorious sources of destruction for the neat rows of ferric oxide that hold data on disks. The half-height hard drive in the reviewed machine occupied the bottom bay of the pair, which might put it at a sufficient distance from the speaker. But you'd be well advised to relocate the speaker if you decide to add a second half-height drive. In fact, you might just want to relocate the speaker no matter what.

Zodiac Technologies uses a proprietary motherboard in the FiveStar and switched the design from one that allowed only add-in memory boards to the current version with provisions for 8MB of SIMMs on the



FiveStar 386/33

Zodiac Technologies,
2100 N. Greenville Ave., Richardson, TX 75082;
(800) 752-5555.

List Price: With 1MB RAM, 40MB hard disk, 1.2MB floppy disk drive, one parallel and two serial ports, game port, monochrome display subsystem, DOS 4.01, Lotus Works, \$2,995; with 4MB RAM, 150MB hard disk, 1.2MB and 1.44MB floppy disk drives, Super VGA display subsystem, \$4,495.

In Short: Zodiac's FiveStar 386/33 has all of the right components, but nothing that makes it spectacular in an arena where the worst that can be said about a computer is that it's competitive.

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motherboard itself. Expansion to the 16MB limit still requires an add-in board in a proprietary 32-bit slot, but at least the first 8MB don't need to interact with the 8-MHz bus.

The eight-slot motherboard is awash with discrete components that take the place of both a large-scale integrated 80386 chip set and a single cache controller. The board had 64K of 20-nanosecond SRAMs installed, an amount that can be expanded to 256K of cache if needed. And an AMI BIOS runs the entire show, apparently to good effect. The PC Magazine Labs suite of 80836 Instruction Mix, Floating-Point Calculation, and Conventional Memory tests places the FiveStar 386/33 among the top of the machines that we tested.

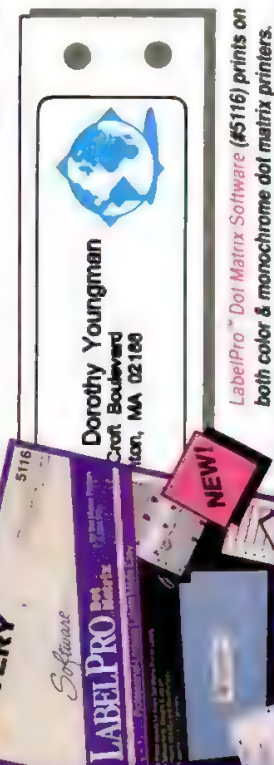
The 386/33 came with a half-height 150MB Micropolis drive and an ESDI controller with 32K cache. Unfortunately, such a small cache size is easy fodder for our DOS File Access tests: 512K just barely contains the small-record test, and over a megabyte is needed for the large-record test. Nonetheless, performance from the 16-millisecond drive, while not outstanding, was certainly competitive with its peers.

Zodiac has elected to include a 16-bit STB Super VGA card, which gets mixed results on our video benchmark tests. Direct writes to the video hardware are ex-

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COMPUTERS

33-MHz 386 PCs

tremely fast and any applications employing that scheme will achieve equally good results. But without the benefit of video shadowing, which unfortunately is not an option for this system, the card simply can't hold its own under the two BIOS operations.

As with many of the computers avail-

Perhaps with some better peripherals, the FiveStar 386/33 would be an easier machine to praise, but in a highly competitive field, this 386/33 is not an outstanding choice.

able from mail-order firms, you'll find little help from Zodiac's documentation unless you're looking for DMA or IRQ information. (It now lacks even the tabbed binders that previously distinguished it.) Zodiac does operate a toll-free support line so someone from the company should be able to talk you through any set-up problems. The system is covered by a one-year parts-and-labor warranty with parts shipping and a fallback to on-site service should the problem be dire or prove intractable. During the first 30 days you can return the system for a refund if it doesn't fit your needs.

Perhaps with some better peripherals, the FiveStar 386/33 would be an easier machine to praise, but in a highly competitive field, both in price and performance, the Zodiac FiveStar 386/33 is not an outstanding choice. ■

Bruce Brown, Edward Mendelson, and Bill O'Brien are contributing editors of PC Magazine. **Fredric Burke and Henry Fersko-Weiss** are free-lance writers and frequent contributors to PC Magazine. **John R. Quain**, another frequent contributor, is an associate editor of Video Review.

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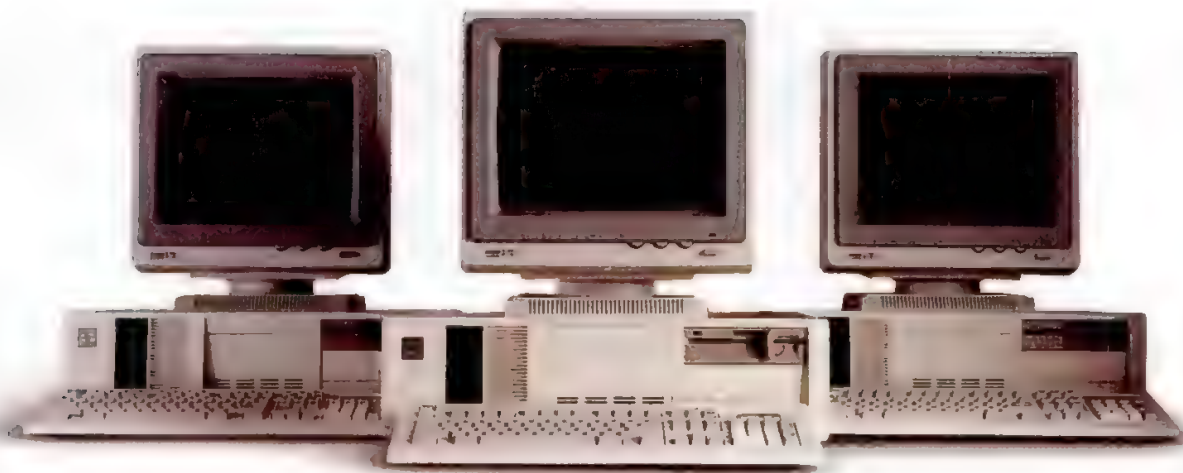
There are two reasons. The first, of course, is the 486™ chip. The other is AMMA™, Everex's proprietary Advanced Memory Management Architecture.

STEP 486/33	34,000 Dhrystones (19.4 MIPS)
CRAY-X-MP/48	17,857 Dhrystones
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**PC Labs
evaluates nine
packages,
ranging from
\$49.95 to \$149,
that help PC
novices avoid
DOS with
menus designed
to activate
applications in
one keystroke.**

Type M For Menuing Software

by Bruce Brown

We may all have a graphical future ahead of us, but today most of us still use unadorned DOS to start applications—or know plenty of people who do. Anyone who uses DOS without *Microsoft Windows* or a task switcher has plenty to cope with, from entering commands to running DOS batch files. DOS demands correct spelling and syntax for filenames and path statements, and consequently, slows down even the most adroit typists. DOS can be

tough, especially for new or part-time PC users, and it can be a big pain in the wrist.

In this evaluation we test nine character-based DOS-menuing packages designed to help you build and use menus to run executable files. They are especially useful to temporary workers or other occasional PC users—the type of users who can really benefit from a screen with explicit instructions like “Type W for word processing.” We’ve focused on packages that include menu-security fea-

tures, and in most cases, maintain and print usage-audit logs that track who is spending how much time in specific files and on what projects.

The packages evaluated here include Magee Enterprise's *Automenu*, Fifth Generation System's *Direct Access*, Progressive Computer Service's *EZ-Menu*, Keyword Office Technologies' *Keyword Commander II*, GetC Software's *Lazy Susan Plus*, Westlake Data Corp.'s *PathMinder+*, The Aldridge Company's *PreCursor*, Harvey Software's *ProDisk Control*, and Data Management Consultant's *ZMenu*.

Since last May's introduction of *Microsoft Windows 3.0*, graphical user interfaces have received a lot of attention. Amidst all the hype, it's easy to lose sight of the fact that vast numbers of organizations still use DOS strictly in character mode and won't move to graphical interfaces until they upgrade their hardware to the acceptable minimum: a 386SX or DX system with 2MB of RAM and VGA

display. As ATs and XTs with DOS intact trickle down the organization to new PC users, the addition of a menuing system can make those machines more immediately usable to these novices.

Menuing software vendors are certainly aware of *Windows*' impact on the marketplace (at least a million units and counting). It's a safe bet that PC users who have not upgraded to GUI environments will continue to demand character-based menu packages for years to come. Several of these vendors are planning *Windows* products as well, but for now they're sure that text-based products are marketable.

A SIMPLE SOLUTION

The nine packages evaluated here can run on relatively low-end PCs. Only a few packages require more than DOS 2.0, 256K RAM, and a single 360K floppy disk drive. Most support a mouse, but none of the products require one. Site

licenses and multiple copy prices of the standalone version are usually available via an arrangement with the vendor.

The packages run in CGA mode up through Super VGA mode, and since they use only text characters for screen information and graphics, there's no loss of readability when they run on a CGA color display.

These menuing systems let you build multiscreen menu systems to start programs, run DOS commands and DOS files, and move between screens through nesting levels or by direct menu linking. For those who can't bear to stay away from DOS, all provide access to the DOS command line.

Each package allows you to protect menus with passwords encrypted automatically or optionally. Password protected systems restrict users from executing certain applications, and perhaps more important, prevent users from changing menu structures. Finally, all the packages provide a method to customize user prompts for menu options.

Two emerging trends point to software with improved functionality and its use as a LAN management tool. There are now automatic menu-creation functions for single machines and special features to assist PC support personnel in designing menus for groups of users. *Direct Access* and *EZ-Menu* use automatic program recognition to find major applications and utilities on disk drives, create menu selections, and execute them. *Direct Access* takes the process a step further by automatically organizing the menu items on different screens by program type.

With *PreCursor*'s less-sophisticated method of creating menus, you must type in the application's executable filename. *PreCursor* searches the hard disk drive's subdirectories until it locates the file, and then creates a menu entry for the program. This halfway measure may seem limited, but *PreCursor* can help you find any program as long as you know the DOS command used to launch the application. In this respect, *Direct Access* and *EZ-Menu* are limited to the applications hard coded by their manufacturers. *PreCursor* will never be out of date because you can use the path-searching feature at any time to modify the menu.

PreCursor also has a menu-cloning feature useful for support staffs who need to create menus for many people in an organization. This feature sets up a master menu that includes all software cur-



EDITORS' CHOICE

Individual Users: • *Direct Access*
• *EZ-Menu*

PC Support Staffs: • *PathMinder+*

Menu programs have come a long way from the simple batch-file systems first seen in the early 1980s. You now have a choice of programs with or without other features such as disk managers and ancillary utilities.

Individual users will do best with *Direct Access* and *EZ-Menu*. *Direct Access* has the most impressive automatic menu-creation facility, recognizing 1,000 standard applications. The program will automatically arrange the applications into submenus that are divided by application type, therefore, setting up a series of intelligently organized menus.

EZ-Menu is jam-packed with features, including automatic menu-item creation for 238 application programs, and incorporates an automatic reset-execution feature to keep unattended systems running in the event of inadvertent reboots.

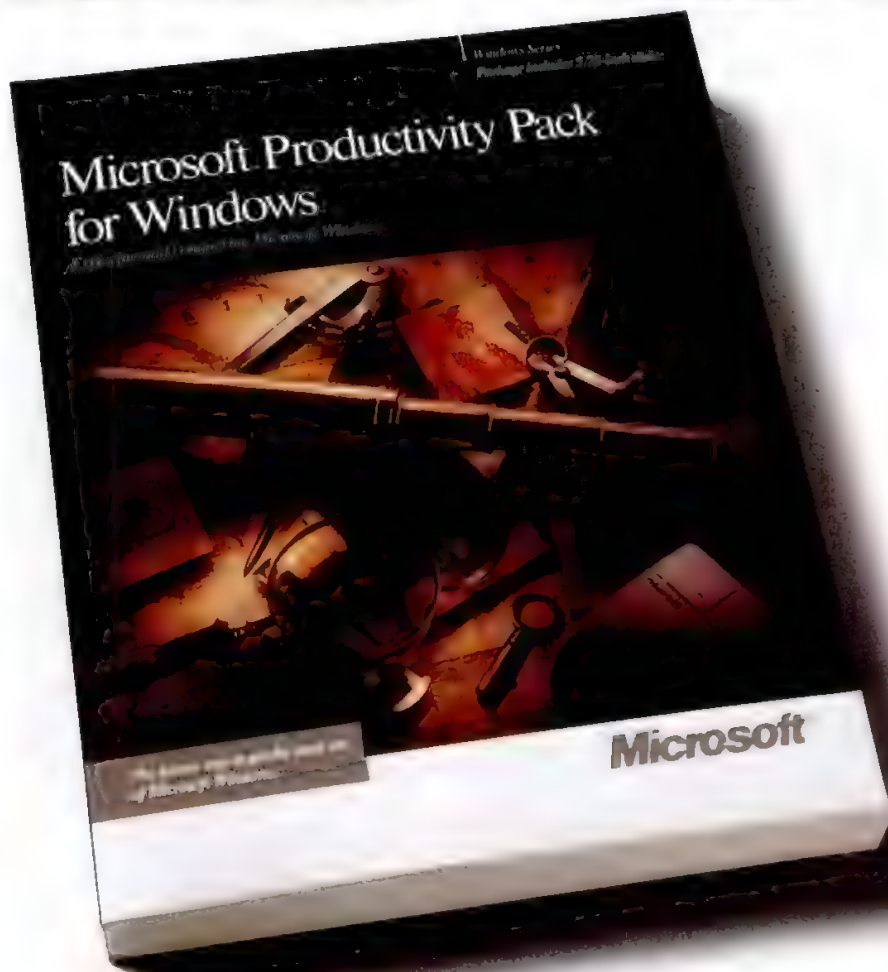
Automenu is a classic menu-creation program that doesn't include automatic menu or item setup. It earns an honorable mention for its

programming flexibility and availability as shareware.

For the PC support specialist, the Editor's Choice package is *PathMinder+*. This program's Reconfigurable User Interface (RUI) accommodates each user's taste for a particular look and feel. With it, a support staff can offer a choice of interfaces to users while keeping the contents of the menus consistent. Honorable mentions go to two other packages with features especially helpful to PC support staffs. *Keyword Commander II* has a remote updating function, which can merge new menu files or download selected menu items in a manner that provides local PC autonomy along with organization.

PreCursor is highly program-mable, and has a menu-cloning facility that enables support persons to set up a master menu listing all supported applications and then easily create user menus that include items only for the software actually installed on individual machines.

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rently supported by your company. Then, to create user-specific menus you run the program on individual users' machines to identify the subset installed on each.

PathMinder+ has a reconfigurable user interface (RUI) function that gives support staffs the flexibility to design custom interfaces for identical sets of programs and commands, and to quickly change interfaces to suit user preferences. With *KeyWord Commander II*, you can selectively update individual menu selections via merged update files and provide support personnel with a solution to two common pressures: user autonomy and organization control. The remote menu-updating function lets users add or edit some of the menu items, but the support staff always reserves the right to change individual selections or submenus.

REVIEW CRITERIA

All of the packages in this evaluation are character-based, DOS-menu utilities used to create menus for starting your applications, running DOS commands, and DOS batch files. Each program includes some level of password protection for entire menu systems, individual screens, or menu options, as well as password encryption.

If you don't want to purchase a menuing package, there are at least two other ways to get some of the same functionality for little or no money. In the sidebar "Writing Your Own Menuing System" we explain how to write simple, batch-file menus to build your own low-end application menu. You can also log onto PC MagNet, where the utilities section has several public domain and "try-before-you-buy" shareware menuing programs. (See the sidebar "Menuing the MagNet Way" for details.)

Automenu

Automenu is a classic in two respects: it was the first widely used PC-based menuing program and one of the most successful shareware products to eventually go retail. It was first published in 1983 by Michael Magee when he was a college student and then distributed on a pay-for-it-if-you-like-it basis. Magee Enterprises now tracks over 200,000 registered users, and there are additional site license agreements, some of which cover thousands of users. The current *Automenu*, Version 4.7, is a minor update to version 4.5 published in 1988.

Automenu lists for \$69.95, and site licenses are available. There isn't a separate network version because the regular version can run on network servers or workstations. *Automenu* has minimal system demands, using just 32K RAM when running in the foreground. Theoretically, depending on the version of DOS you use, you could run *Automenu* on a PC with just 64K RAM and one floppy disk drive. *Automenu* is a text-based package that supports all video modes and includes a special LCD mode to force black and white onto portable computers for improved clarity. *Automenu* was the first menuing program to support the use of a mouse, but a mouse isn't required.

The well-written, 114-page manual includes an index and a quick reference card, but only one screen shot. You install *Automenu* on your system via a self-running program, but then you must configure the system's menus and menu options.

With the normal installation procedure, *Automenu* takes up 212K of hard disk space, but if you delete nonessential files it only needs about 74K.

Automenu can run in a "memory dormant" mode that doesn't use system interrupts to conflict with any other program or system activity. When you run applications from *Automenu* only 80 bytes are reserved to restart the menu system.

THREE USER MODES

Automenu uses menu definition files (.MDF) to control menu organization and functions. There are three user modes—beginner, intermediate, and advanced—in a program called AUTO-



FACT FILE

Automenu, Version 4.7
 Magee Enterprises
 Inc., P.O. Box 1587,
 Norcross, GA 30091;
 (800) 662-4330,
 (404) 446-0271.
List Price: \$69.95.
Requires: 64K RAM,
 DOS 2.0 or later.

In Short: *Automenu* is one of the original menu programs and is still available as shareware so you can try it first to see if you like it. It doesn't have some of the fancy features included in the competition's packages, and to get the most from the program you need to do a bit of programming, but once the menu system is set up it's intuitive and very easy to use.



CIRCLE 396 ON READER SERVICE CARD

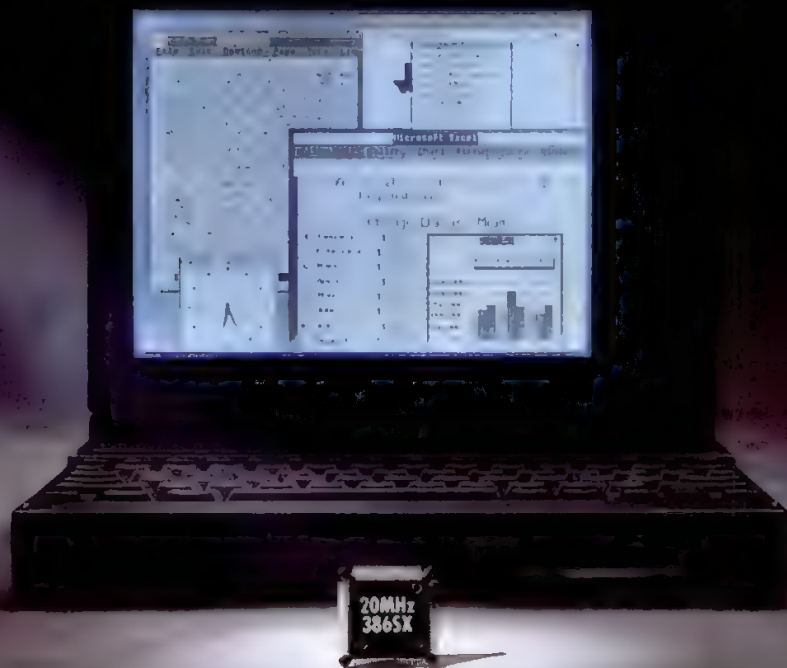
MAKE, which is essentially a menu-editing program. In the simplest mode, you build menus interactively by responding to prompts; in intermediate mode you edit existing menus; and in advanced mode you can start from scratch to design your own .MDF file, a task similar to simple programming. Writing .MDF files isn't difficult, but novice users should probably get help.

The menu screens are linked rather than nested, so you can move from menu to menu without having to back out of one chain to get to another menu. Screens can have a maximum of eight menu choices, and there is no limitation to the number of linked menu screens. All menu items need to be entered, since *Automenu* does not build menus or find application programs on its own. It will, however, search your hard disk for executable commands. Menu items can include any executable program, DOS, or batch file.



Automenu lets you use up to eight menu items per screen with unlimited linked screens. The package has setup modes for novice, intermediate, and advanced users.

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SOFTWARE MENUING SYSTEMS

PASSWORD SECURITY

Automenu doesn't use individual user passwords, instead it uses menu selection. By having an initial screen with just one choice protected by a password, the menu can keep users from accessing the entire system or from exiting to DOS. Selection passwords can also protect full-menu screens by restricting access from all other menus. In addition to password security, the entire menu file can be encrypted and protected by a password as well. This double indemnity is a good way to set up a menu system that novice users and snoopers can't corrupt. *Automenu* does not maintain usage logs.

Automenu has moderate screen-customization facilities. You can specify color and menu and selection prompts, all within the menu definition file. One particularly nice feature is the ability to set up timed execution of a menu selection. With this feature, you can print reports during nonbusiness hours by running a DOS batch file to activate an application using the application's built-in autoloader macro facility.

Extra features include a screen-blanking utility and the ability to shut off the date and time display, which is especially useful for speech systems used by handicapped users. The computer reads every new entry on the screen and therefore announces every date and time change.

Automenu is designed for the novice to use, but not necessarily to set up independently. The target user is a corporate system support person who configures menus for companies and individual users. *Automenu* is a flexible menu program without lots of major features and functions. If you like simplicity and don't mind a little programming, *Automenu* may be the one for you.

Direct Access

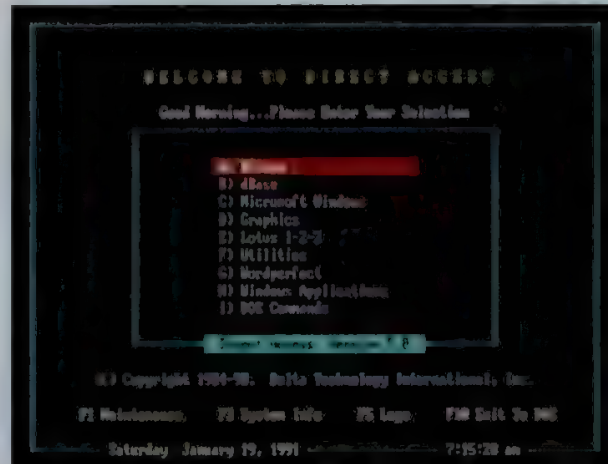
The ideal menu system should combine easy default setup, extensive customization options, and the right combination of usage support features. Most importantly, it should let you find and execute programs simply and quickly. Fifth Generation Systems' *Direct Access*, Version 5.0, is the current leader in all of the above functions.

Direct Access 5.0 costs \$99 in its standalone version, with site licenses available by arrangement. *Direct Net*, a \$245 server

version of *Direct Access*, supports unlimited users and includes extra network security and management features.

The program, which requires a hard

organizing application programs on your hard disk drives. If you only use a few programs, this feature isn't particularly important, but if your system is packed with programs, don't worry, because *Direct Access* can currently identify 1,000



Direct Access automatically finds major program files and, if you wish, builds a menu hierarchy automatically. This screen shows a menu created with no user input.

disk, uses approximately 888K of disk space under normal installation. Using it on a floppy disk drive-only system wouldn't leave room for much else. The text-based package supports all major video modes, and although there is no special LCD monochrome mode as in *Automenu*, you can set the screen colors to black and white to simplify two color use on portable computers. You can use a mouse to run *Direct Access*, although one is not required.

Direct Access does not run as a memory resident program. Instead, it runs in the foreground and then backs out of the way when you execute an application program, needing only the DOS minimum of approximately 80 bytes to reactivate when you leave the application you're using.

The program's manual is very helpful and includes an index with screen shots. If you don't want to use the manual, all you really need to do is put the first program disk in drive A:, make A: the default drive, type INSTALL, and hit the Enter key. On-screen instructions guide you through the installation process. You'll want to use the manual to set up customizable usage reports, but even that process is possible using the package's prompts and on-line help screens.

AUTOMATICALLY FINDS PROGRAMS

Above all else, *Direct Access* shines at automatically finding, installing, and

of them—not only by executable filename, but also by program category. When I installed it on the PC in my office, I sat back while *Direct Access* found over 20 programs and utilities in my directory and organized them into submenus by program type. This is an extremely slick feature and it should be carefully studied by all competing vendors of menuing packages.

Direct Access allows a maximum of 26 menu options per screen and lets you nest menus six levels deep. Menu selections can start any executable file, including .COM, .EXE, and .BAT files. You also use a menu option to move to different levels and specify messages or prompts for any menu. The informative, simple-

FACT FILE
EDITORS' CHOICE

Direct Access, Version 5.0
 Fifth Generations Systems Inc., 10049 N. Reiger Rd., Baton Rouge, LA 70809; (800) 873-4384, (504) 291-7221.
List Price: \$99.
Requires: 256K RAM, DOS 2.1 or later.
In Short: *Direct Access* 5.0 has the most impressive automatic setup features of the programs reviewed. It's quick, attractive, and easy to maintain.

CIRCLE 397 ON READER SERVICE CARD

to-use default screen may be too busy for some tastes, but you can configure the display to turn off screen prompts, time and date displays, and menu option bar highlighting.

Two of *Direct Access*'s special display features emphasize the program's user orientation. You can customize your own logo or any other graphics screen in a graphics or paint program, save the file in .PCX format, and have *Direct Access* display the graphics screen whenever you start the program. The time-and-date display also greets you with "Good Morning," "Good Afternoon," or "Good Evening."

SECURITY AND TRACKING FEATURES

Direct Access has extensive security features, including encrypted password protection for the whole system, for menus, and for specific options. You can also restrict user access to DOS via passwords. There is no limit to the number of user passwords, and you can assign project ID numbers to menu items and create a validation list of up to 75 users who can access an item associated with a project.

This feature is especially helpful if you're going to use *Direct Access*'s usage tracking system. The program has several

Direct Access has extensive security features, including encrypted password protection for the whole system, for menus, and for specific options.

default usage reports but gives you impressive control over report content and format, including sort and select by user name, application name, project ID, and date and time.

MENUING THE MAGNET WAY

by Bruce Brown

PC Magazine's on-line database and user forum system, PC MagNet, includes several public domain and shareware menuing programs. We didn't evaluate these programs here, but if you want to check out free or try-before-you-buy menuing packages, here's a quick rundown of what's available on PC MagNet.

All of the programs mentioned below are stored in binary file format, so you need a communications program with binary-file download capability to retrieve them from MagNet's download libraries. (For information on accessing PC MagNet, see page 8.)

HDAM50.ZIP—*Hard Disk Applications Menu*, Version 5.0, uses pull-down menus with multilevel passwords, and it includes a menu of common DOS commands.

BATMEN.EXE—*Batmenu* creates batch-file menus with up to 30 menu items. It requires DOS 3.3 or later, and includes a menu editor to create custom menus.

BCSMNU.EXE—*Bristol Computing Professional Menu System* offers unlimited menus with mouse support and custom palette control for EGA and VGA displays.

DISKDI.ARC—*Point and Shoot Menuing System* creates a menu system with up to 90 menu selections. It runs pro-

grams, DOS commands, and DOS batch files.

EASY43.ARC—*Easy Access 4.3e Hard Disk Menu System* lets you set up unlimited nested menus with up to 16 selections each, and has two levels of passwords and usage logging. Other features include a calendar with event alarms, screen blanker, and definable headings and menu colors.

MENU311.ZIP—*Menu System*, Version 3.11, is a batch-file processor that supports submenus. It utilizes keyboard function keys and also includes a menu editor.

MM170.ARC—*Magic Menus* is loaded with features, including 100 menu-item support with pull-down menus, a DOS shell, pop-up calculator, printer control, passwords, screen editing, macros, mouse support, and on-line help.

ORGN13.EXE—*The Organizer* provides one-key menu selection, a DOS command formatter, and an appointment scheduler.

PAS13.ARC—*Point & Shoot* allows up to 300 menu items, has mouse control, directory and file information, DOS command-line access, an editor, and a file viewer.

PCDSH.ZIP—*PC Dashboard* uses single-key program execution and optional password protection. ■

VIRUS DETECTION

Direct Access includes three levels of general software virus detection features. If virus detection is turned on, the program looks for the symptoms of viruses, such as changed application files, rather than detecting specific viruses. When active, the package checks each time you start an application. Since this step adds time, it's recommended that you set the virus detection to level 3, which checks only when installing a new program. Otherwise leave it at level 1, which imposes a minimal wait. If you never install or download new files and don't use floppy disks from other people you can probably skip virus detection.

Direct Access includes system and disk information screens, a tree-style directory-display function that also shows executable files in a window, and a screen blanker that lets you specify the time to wait before clearing the display. Overall, *Direct Access* is the most well-rounded, standalone PC-menu system around. It's highly customizable and has impressive usage-reporting capabilities, but since the implementation is so coherent, *Direct Access* makes sense for novices and power users alike.

EZ-Menu

Progressive Computer Services calls *EZ-Menu*, Version 5.0, "The Ultimate Computer Organizer." If the number of features and functions is the sole measure of program usefulness they may be right, for this is an extremely feature-rich system.

SOFTWARE

MENUING SYSTEMS

MENUING SOFTWARE: SUMMARY OF FEATURES

Products listed in ascending price order

	ProDisk Control	ZMenu	EZ-Menu	Automenu	Keyword Commander II	PreCursor
List price	\$49.95	\$59.00	\$59.95	\$89.95	\$89.95	\$96.00
SYSTEM REQUIREMENTS						
Amount of drive space used	488K	278K	384K	100K	90K	292K
Network compatible	■	■	■	■	■	■
Supports mouse	■	□	■	■	■	■
OPERATIONS						
Memory resident mode	■	□	□	■	□	□
Memory used in background	14.8K	N/A	N/A	26K	N/A	N/A
Foreground mode	□	■	■	■	■	■
Unlimited drive support	■	■	■	■	■	■
Automatic screen blanker	□	□	■	■	■	■
DOS command access	■	■	■	■	■	■
Integrated DOS commands	20	None	50	None	18	10
MENU STRUCTURING						
Maximum menu items per screen	20	8	26	8	12	11
Maximum number of menu levels	Unlimited	100	Unlimited	N/A	676	Unlimited
Menu nesting	■	■	■	□	■	■
Automatic menu building	□	□	■	□	□	□
Number of programs recognized	N/A	N/A	238	N/A	N/A	N/A
One-key item selection	■	■	■	■	■	■
Menu items can include:						
Applications	■	■	■	■	■	■
DOS batch files	■	■	■	■	■	■
DOS commands	■	■	■	■	■	■
SECURITY						
System passwords	■	■	■	■	■	■
Menu passwords	■	■	■	■	■	■
Application passwords	■	■	■	■	■	■
Encrypted passwords	■	■	■	■	■	■
DOS access protection	■	■	■	■	■	■
Maximum number of users	Unlimited	24	Unlimited	Unlimited	7,437	Unlimited
USAGE TRACKING						
Logs users	■	■	■	□	■	■
Maintains usage audit	■	■	■	□	■	■
Default usage reports	■	■	■	□	■	■
Customizable usage reports	□	□	□	□	□	□
Billing based on time and rate	□	□	□	□	□	■
CUSTOMIZATION						
Customizable screen colors	■	□	■	■	■	■
Customizable screen display	■	□	□	■	□	□
Customizable general help/user prompts	■	■	■	■	■	■
Customizable specific help/user prompts	■	■	■	■	■	■

 Editor's Choice ■—Yes □—No
 N/A—Not applicable: The product does not have this feature.

Adding to the program's appeal is *EZ-Menu's* impressive self-installation and program-recognition functions.

EZ-Menu lists for \$59.95 for a single user version, with site licenses and multiple copy deals available. A \$249 network server version should be available by the time this article is in print. *EZ-Menu* runs in the foreground rather than as a TSR and reserves just 80 bytes of memory while running applications.

Adding to the program's appeal is *EZ-Menu's* impressive self-installation and program-recognition functions.

Installation is through a self-running install program with configuration options presented on the display. After standard installation, *EZ-Menu* takes up 348K of drive space, but you can cut some of the nonessential files to limit the space taken to about 150K. The manual is well-written and includes an index, but it doesn't have screen shots. Since *EZ-Menu* uses fairly busy screens, screen shots in the manual would be helpful, especially for



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SOFTWARE MENUING SYSTEMS

ability to update whole menus or even single menu options will find Keyword Office Technologies' *Keyword Commander II*, Version 1.1, an admirable system. *Commander II* also has an extensive documentation facility for creating on-line help screens.

Commander II lists for \$89.95. A \$395

***Commander II* lets support staffs provide local autonomy and system-wide control at the same time. You could let users configure function keys F1 through F6 independently but reserve F7 through F12 for system-wide standards.**

network version that can be installed on the file server of any DOS LAN is also available.

Running in the foreground, the package takes up just 1.7K when running applications. It uses only 90K of disk space if all program files are installed and 36K if you unload optional files.

To install *Commander II* you just copy three files from the distribution disk to your system drive. You can install *Commander II* in the root directory or in any subdirectory included in your system path. The 88-page manual is well-done and includes an index and a moderate number of screen shots.

BUILDING MENUS MANUALLY

Commander II's interface, which is not customizable beyond color choices, uses function-key assignments with key label boxes on the screen. A given screen can have up to 12 options and the program supports up to 676 different menus. When you define or modify function-key assignments—which you can do at any time by holding the Alt-key and pressing the function key whose menu option you want to edit—the on-screen arrangement changes immediately depending on the number of function keys used.

Menu options can include any executable .EXE, .COM, or .BAT file. Menus can be nested or linked, and there are also special "floating" menus that can be invoked with the Alt-G key combination and called by a menu identifier. For example, you might have a set of DOS commands set up in a floating menu to call up at any time. Menu options can be linked to run sequentially. You could set it up so that every time you exit a given program a menu option to back up all new files is invoked. *Commander II* does not build menus automatically, so you have to specify all executable files and paths.

MULTIPLE USER SUPPORT

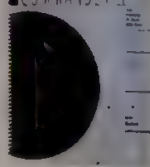
Commander II's updating feature is appealing because of its flexibility. In both the standalone and network versions, the full system, individual menus, and even single-menu options can be updated easily. In standalone systems you can merge menu changes by program command or from the DOS command line. Network versions can change user menus from the server. By combining ease of local-menu

modification and a flexible menu-updating feature, *Commander II* lets PC support staffs provide local autonomy and system-wide control at the same time. For example, you could let users configure function keys F1 through F6 on all menus independently but reserve F7 through F12 for system-wide standards.

The help-system documentation feature allows you to merge ASCII text files up to 70 characters wide and 94 lines long into scrollable menu or help screens that can be reached at any time by pressing

FACT FILE

Keyword Commander II, Version 1.1
Keyword Office Technologies Ltd.,
2816 11th St. N.E.,
Calgary, Alberta,
Canada T2E 7S7;
(800) 661-8161,
(403) 250-1770.
List Price: \$89.95;
network server version, \$395.
Requires: 128K RAM, DOS 3.0 or later.
In Short: *Keyword Commander II* is especially useful for creating and maintaining menus for many users. Its most impressive feature is a remote menu updating function that enables a support person or LAN manager to provide a menu system with both local PC or department autonomy and overall organizational control.



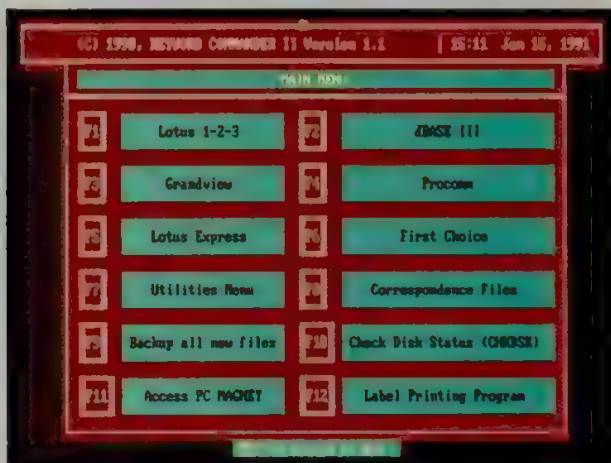
CIRCLE 398 ON READER SERVICE CARD

Alt-H. Each option can have both a help screen and an information screen that prints information on the screen before executing the menu option.

Encrypted passwords are associated with individual function keys in specific menus rather than by users. The maximum number of users potentially controlled by passwords is 7,437 (leaving one option per menu to call a different menu and adding one option for the last menu in the system). With creative use of function passwords you can restrict users from DOS and can also stop them from changing menu structures.

Usage logs can be automatically maintained with a default usage report dumped via a function key into an ASCII file for later editing.

Commander II's menu-control and documentation features are well implemented and especially useful for those who have to support multiple users. For a single-user system, the program is appropriate if you want the updating and on-line help features.



Keyword Commander II makes ample use of keyboard function keys. Each menu screen can store up to 12 menu options with a system total of 676 separate menus.

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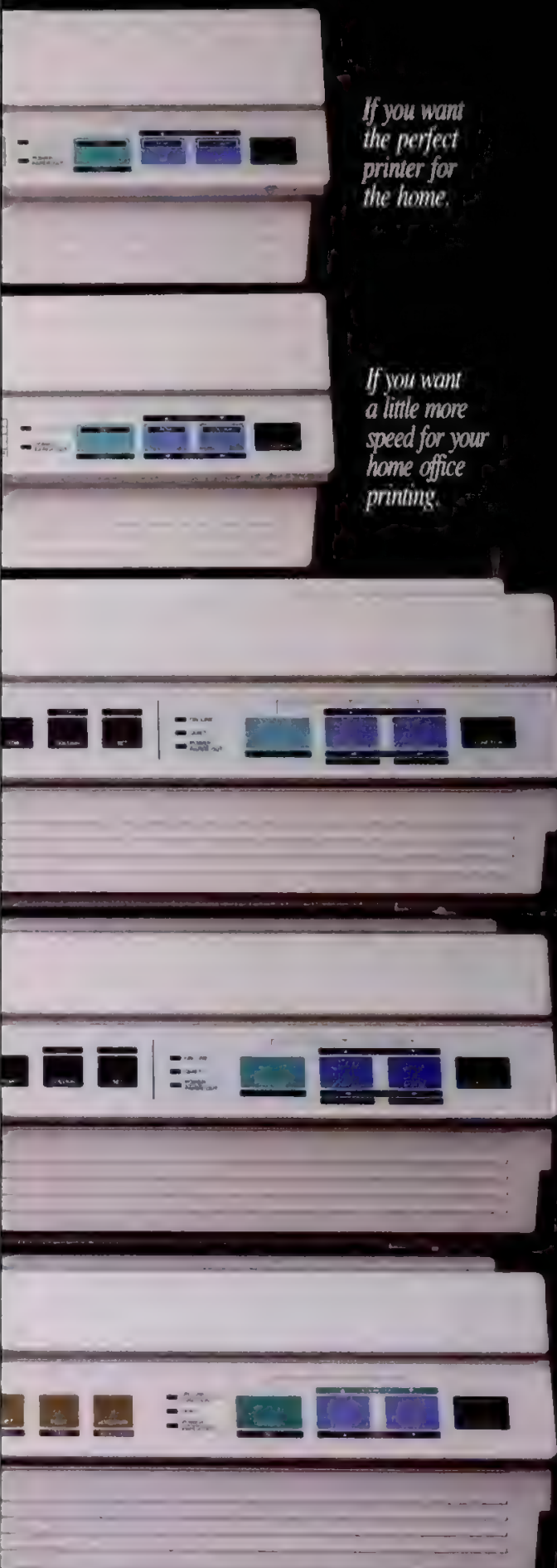
after another,

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after another,

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Lazy Susan Plus

GetC Software's *Lazy Susan Plus* shines in its simplicity. It incorporates a basic menu structure that's easy to set up, learn, and use. In addition, it has password protection and usage logging. Version 4.1 is actually three programs in one: the *Lazy Susan* menu program, the *MultiMax* file management system, and the *MaxEdit* text editor.

You can buy *Lazy Susan* for \$79.95,

directory or to a special subdirectory. With all of the files copied the package uses 288K of hard disk drive space, though you can reduce this amount by deleting unnecessary files. A runtime version that restricts users from changing the menu system and a configurable version are also included on the disk. The documentation that is offered with the program is minimal, omitting screen shots as well as an index.

NESTED MENUS

Lazy Susan Plus runs in the foreground and reserves 25K of RAM. With *Lazy Susan* you can go into DOS to issue commands and access a standard command screen that includes five standard DOS functions: CHKDSK, DIR, FORMAT, DATE, and VER.

Individual menu selections can call applications, execute DOS commands and batch files, and move to other menus. Function keys are used to execute major operations—moving between menus, selecting menu options, screen blank, and locking—and skip the menu-nesting system to go directly to the main menu or the user menu.

One *Lazy Susan Plus* menu can have as many as 100 selections, with a maximum display of 14 at one time. Menus can be nested to 15 levels, allowing ample space for menu selections and organization. The PgUp and PgDn keys allow you to move between screens.

Encrypted user passwords can protect the whole system, individual menu levels, or single applications if you configure a menu to include just one application. You

can assign passwords to more than 1,000 users and set the optional usage log to track up to 9,999 instances of program use. The default log size is 100 items, but it can be changed with *MaxEdit*. The default log tracks by user, program, or usage details, but cannot be customized. You can rearrange the ASCII text report with *MaxEdit* or another text editor or word processor.

MACRO FACILITY

Lazy Susan Plus has a macro facility to record keystrokes that access menus and make selections. You can invoke a maximum of 26 hot-key macros with two keystrokes, and there's a screen blanker paired with a lock feature that password protects your system until you reenter the required password.

Lazy Susan Plus is simple to set up and use, but it doesn't include automatic menu setup features like many of the more-powerful packages that we have evaluated here. It's an adequate system if you need nothing more than the simplest menu control with password protection and basic usage tracking.



FACT FILE

Lazy Susan Plus, Version 4.1
GetC Software Inc.,
P.O. Box 8110-182,
264 H St., Blaine,
WA 98230; (800)
663-8066, (604) 684-3230.
List Price: \$119.95
including *MultiMax*
and *MaxEdit*; for
Lazy Susan only, \$79.95; eight-user network
version, \$295.
Requires: 256K RAM, DOS 2.0 or later.
In Short: *Lazy Susan Plus* is a character-
based menuing program sold with separate file
and directory managers and text editors.
There are no automatic menu setup facilities,
but it's an adequate menu program with a
convenient menu macro facility.

CIRCLE 400 ON READER SERVICE CARD



the *Plus* edition, including both the file manager and the text editor for \$119.95, and an eight-user network version for \$295. A mouse is not supported by the package.

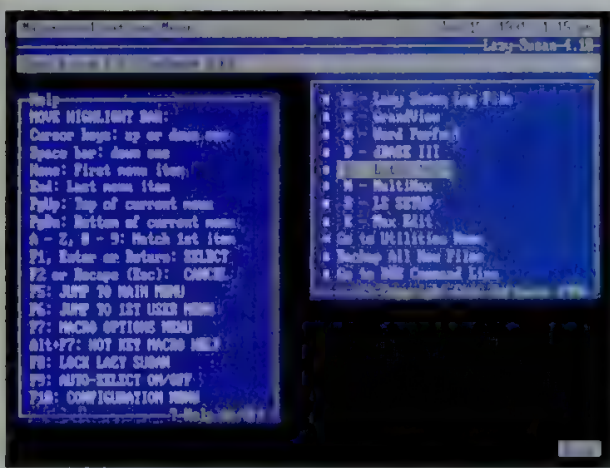
In order to install *Lazy Susan Plus*, you have to copy the program files to the root

PathMinder+

With Westlake Data Corp.'s *PathMinder+* you can design multiple user interfaces for a variety of tastes—a useful feature for system administrators and PC support staffs who need to configure menu systems for many PC users. At \$149, this text-based system is a bargain. It runs on standalone PCs and network workstations, however, it is not a multiuser package for installation on a network file server.

PathMinder+ runs in the foreground and uses only 4K RAM when running applications. It supports mice, which includes use with pull-down menus, dialog boxes, and scroll bars. There's also a simple default installation via a self-running program.

PathMinder+ does not automatically build menus by recognizing software stored on your hard disk, and it doesn't include predefined DOS-command menus. Instead, you set up menu options to run applications, DOS commands, and batch files, and to access nested or linked menus. You can also teach *PathMinder+* to launch applications and load files by pairing file extensions with specific applications. The number of menu options per



In Lazy Susan Plus's menu system, individual menu items can call applications, DOS batch files, and exit to the DOS command line. In addition, it can invoke the setup program, the user log file, and run the included file and directory managers.

screen depends on the interface you choose, and the number of menus is limited only by disk space.

Instructions on how to customize menus and interfaces are included in the extensive documentation, complete with an index and plentiful screen shots.

FLEXIBLE USER INTERFACE

The Reconfigurable User Interface (RUI) allows you to control all of the system menu features and save the configurations in an interface file. The package comes

with two predefined interfaces: PathMinder User Interface and an SAA-compatible setup.

PathMinder+ automatically assigns an unlimited number of encrypted passwords, which restrict access to the entire system, separate menus, individual options, or to

WRITING YOUR OWN MENUING SYSTEM

by Bruce Brown

If you use only a few applications and would like to create your own menu system quickly and easily, consider writing your own DOS batch files to start programs.

DOS batch files are simple text files, saved in ASCII file format, that contain one or more valid DOS commands. When you run a batch file, the computer executes each command in the file one at a time. Batch filenames can have just one letter or number, or up to DOS's limit of eight characters. The file extension for DOS batch files must be .BAT. DOS batch files can let you start applications with just one keystroke and enable you to pass optional command parameters if those extra instructions are included in the batch file.

You can create DOS batch files with a text editor, a word processor (be sure to save the file in ASCII format), or even more simply, directly from the DOS command line using the COPY CON <FILENAME.EXT> command.

Later versions of DOS support batch files that can call other batch files and then return control to the original batch file, but even the earliest versions of DOS let you set up the simple type of batch-file menu we'll create here.

WRITING THE BATCH FILE

Let's start by assuming that you have *Lotus 1-2-3* stored in a subdirectory named C:\LOTUS and you normally start the program by typing LOTUS on the command line. When you're done, you then switch back to your computer's root directory C:\.

At the root directory DOS prompt type the following:

```
COPY CON L.BAT (Enter)
```

This command tells DOS to watch the keyboard (CON, short for console) and

copy whatever you type to save it in a batch file called L.BAT. After you enter the above line, your cursor returns to a blank line. Now you're ready to type any number of valid DOS commands. So enter the following lines, each followed by the Enter key:

```
CD\LOTUS
LOTUS
CD\
```

The first line switches to the C:\LOTUS subdirectory, and the second line starts the Lotus Access program. After you quit *1-2-3*, the third line returns you to the root directory of the current drive.

The last step in creating a batch file is to save it. If you've been typing in the lines exactly as described above, at this point your cursor should be at the beginning of the line, directly after the lines that tell the computer to return to the root directory (CD\). To save the batch file tap the F6 function key (you'll see ^Z on your screen). Then tap the Enter key and you'll see the words:

```
1 File(s) copied
```

on your screen. The file is saved.

If you only have a few programs and want to start them with a single key from the DOS prompt (and you can remember them), you can create one start-up batch file for each program. Then you can load and start the program by typing the appropriate single-letter batch filename key and hitting the Enter key. In the example above, you'd tap "L" and then hit Enter. That will run the batch file and start your program, in this case *Lotus 1-2-3*.

If you want an actual menu on the screen, you have to create a single, ASCII text file to list all the batch file letters and indicate their function. Then you save this menu "screen" file and call it up with another batch file.

For example, using an editor, word processor, or even with the COPY CON technique, you can create a simple menu-screen text file called MENU.TXT. Here's a simple version of a menu-screen file displayed on a screen:

```
My Applications Menu
```

```
L—Lotus 1-2-3 2.01
```

```
W—WordPerfect 5.0
```

```
D—dBASE IV 1.1
```

After you've created such a file and saved it with the .TXT extension, you can call it up on the screen with the following batch file, called MENU.BAT:

```
CLS (to clear the screen)
TYPE MENU.TXT
```

With the MENU.TXT and MENU.BAT files created and saved on your disk, all you have to do is type "MENU" to run the batch file (MENU.BAT), which clears the screen and displays the contents of your menu file (MENU.TXT). At the bottom of your menu screen the regular DOS prompt will be displayed, waiting for you to enter the single-letter batch filename used to start a program. (Note that the displayed menu screen isn't an active program, just a prompt. If you want to do anything else in DOS you can.)

If you create the simple start-up batch files or the menu screen as described above, you may want to go further. You can have menus call other menus, pass required or optional program parameters along with application start-up commands, include common DOS commands, or any other action normally entered straight from the DOS command line. ■



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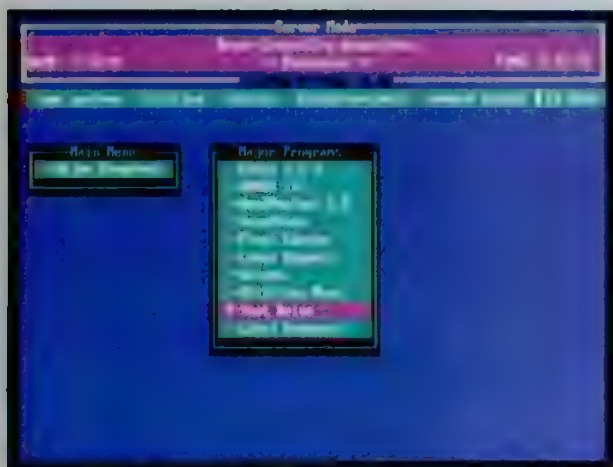


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PreCursor uses pop-up menu windows with a maximum of 11 options per menu. Once you type in the filenames for the programs you want to appear in the menus, the package searches your drive to find the path to that program.

vide an applications interface function via control codes and commands.

PASSWORDS RESTRICT ACCESS

PreCursor encrypts passwords for an unlimited number of users and can restrict access to DOS, the menu system, particular menu screens, or specific menu selections. For additional security you can also set separate project IDs and restrict access by user or project ID. All system usage can be logged (for unlimited users) and printed in default format reports. The default reports show all activity, application summaries, user summaries, and project summaries.

PreCursor is impressive for its intelligent menu cloning and programming features. Single users will certainly find *PreCursor* easy to use for simple menu systems, but the advanced features make it especially appealing to computer support persons.

other TSRs. Depending on the size of the various menus, *ProDisk Control* uses up to 64K RAM. You can reduce RAM usage to under 15K by inserting a parameter before any menu selection's command line entry. A mouse is supported but not required.

You install *ProDisk Control* via a self-running program that pauses only to ask for master and user passwords, and to check your system for a real-time clock. This last question indicates the program's fairly low level of sophistication. The 50-page manual is a text-only document, lacking screen shots and an index, but there is an on-line manual to aid in using DOS commands.

DEFINING MENUS

Once the system is installed you can define up to 20 selections per screen with unlimited menu nesting. To define a menu selection you enter the command or op-

eration title you want to appear in the menu, followed by the command line indicating the path where the command is stored. Menu options can include executable files, DOS commands, DOS batch files, and commands to load another *ProDisk Control* menu. All menu-editing operations are controlled with keyboard function keys. A sample menu file that you can incorporate into your menu system includes 20 DOS commands.

If you install passwords for menu sets, you can control DOS access, the entire menu system, and individual menus. You can also use a master password to override other passwords. You can track menu-selection and DOS-command use with a log file and print it to an ASCII file for viewing or editing.

ProDisk Control doesn't compete with the more-powerful programs in this review. It uses a lot of hard disk space and lacks automated functions, but it does offer two advantages: ease of use and low cost.

FACT FILE

ProDisk Control, Version 4.0
 Harvey Software Inc., P.O. Box 06596, Fort Myers, FL 33906; (800) 231-0296, (813) 482-8600.
 List Price: \$49.95.
 Requires: 128K RAM, DOS 2.0 or later.
In Short: *ProDisk Control* is an inexpensive and simple program without many fancy features. Ease of use is its strong suit.

CIRCLE 403 ON READER SERVICE CARD

ProDisk Control

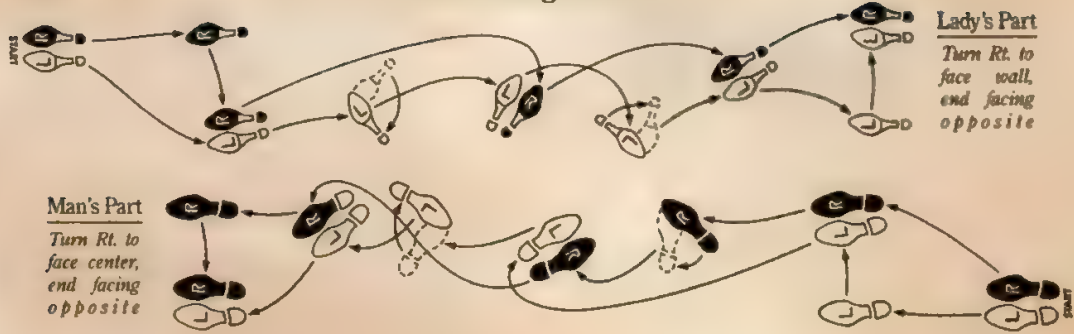
Harvey Software, a systems house that develops software packages for the shipping industry, sells *ProDisk Control*, Version 4.0, as a standalone version or in conjunction with vertical market software. This simple and inexpensive text-based menu program, which lists for \$49.95, comes with password protection and a usage log tracking feature.

ProDisk Control runs as a RAM-resident TSR and does not take keyboard interrupts, so it stays out of the way of



ProDisk Control lets you enter up to 20 menu items in a single menu with unlimited menu nesting and linking. The package can maintain multiple-level user passwords and system usage logs but remains simple to use.

The Saratoga Fox Trot



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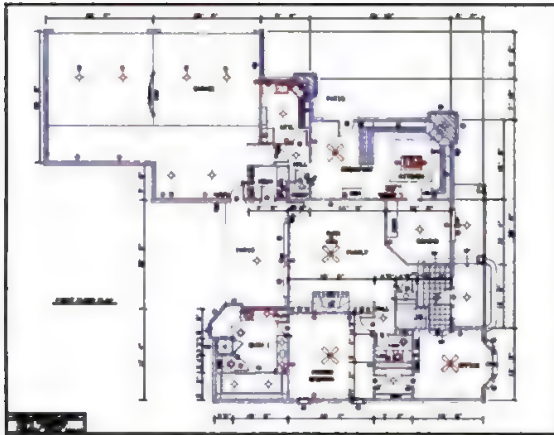


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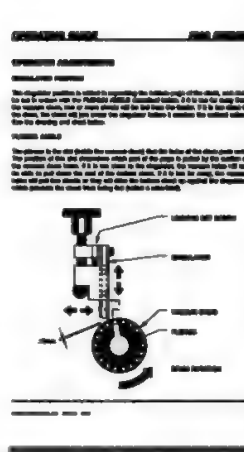
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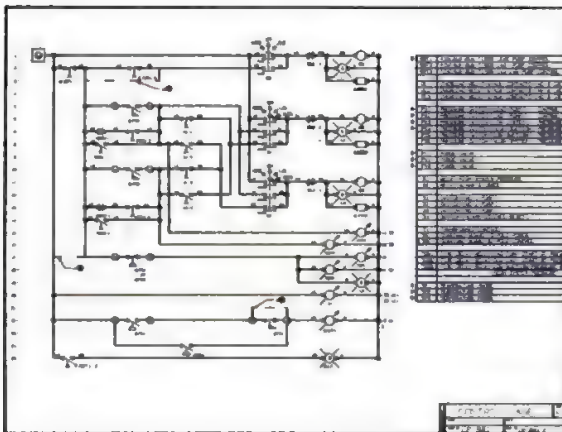
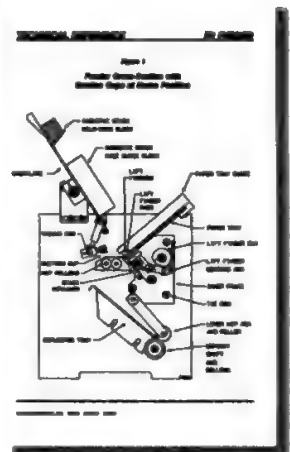
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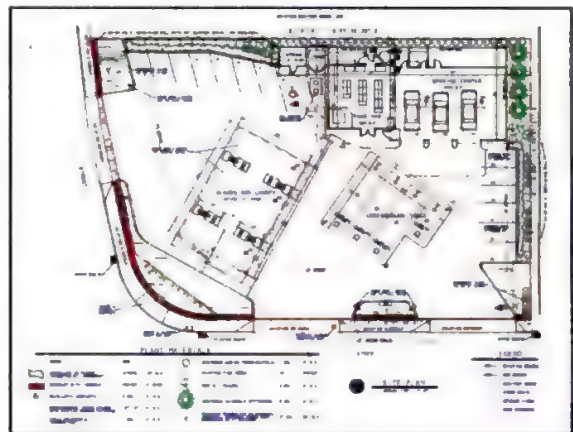
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ZMenu

ZMenu is too limited for typical DOS users. Version 5.0, the current version, was first released in 1985 and is primarily sold with another Data Management Consultants product, *ZView*, a C programming language screen generator.

ZMenu lists for \$59. Normal installation uses 278K of hard disk space, but by deleting unessential files you can cut the storage to 110K.

The program's manual is skimpy, lacking screen shots and an index. The *ZMENUSYS* program lets you edit up to 24 user security codes, menu options, and displays or prints the system log file. Each user has a code, a user name, and a security level from 00 to 99—00 is the level with the greatest access rights.

A given menu can display up to 16 options in pages that each contain eight options. Menus can nest a maximum of 100 levels. While menu selections can include any executable filename, including DOS commands and batch files, it's at this basic level that the program loses appeal for most DOS users.

Unless your system path includes every subdirectory your applications must access (a wasteful if not impossible restraint), you cannot use *ZMenu* to load executable application files directly because the program doesn't change to the executable file's subdirectory when it loads the program. I was able to set up applications on the menu by writing DOS batch files that change the directory, load the application, and then change the directory back to *ZMenu*'s path after exiting the application, but that's a silly process

SOFTWARE MENUING SYSTEMS

unless you like to write batch files.

ZMenu does have some nice features, such as menu selection chaining. The major, real-world use for *ZMenu* is for C programmers who can use it as a front end for customized applications. *ZMenu* is useful in the C world because it can pass security levels through to applications, even down to the field level, but that's



FACT FILE

ZMenu, Version 2.0
Data Management Consultants, 5030 Paradise Rd., Suite A-112, Las Vegas, NV 89119; (800) 423-0930, (702) 798-5910.
List Price: \$59.
Requires: 64K RAM, DOS 2.0 or later.

In Short: If you are a C language programmer and want to be able to pass parameters or security control to C programs, even down to field level, take a look at *ZMenu*. Otherwise the package is too limited for regular DOS application users.



CIRCLE 404 ON READER SERVICE CARD

useless if you use word processors or spreadsheets.

C programmers will probably remain *ZMenu*'s most-common customers. It's not a particularly easy program to use and doesn't gracefully support application command-file execution. This program is not recommended for regular DOS application users.

Bruce Brown is a contributing editor of PC Magazine.

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ZMenu allows eight menu items per display, with two possible pages for each menu and 100 menus per menu system. Menu options can include application programs, DOS commands, and batch files.

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November 27, 1990
Smart UPS 400



Building Workgroup Solutions:

Special-Function Servers

PC LAN Labs reviews five special-function servers that speed up LAN throughput by relieving the file server of print server and communications server duties, while generally costing less than dedicated PCs.

by Frank J. Derfler, Jr.
In late 1990, a new category of products showed up at PC LAN Labs. At first, we called them *Ethernet peripheral-sharing devices*. This mouthful of words describes their function, but it isn't a phrase likely to stick in the minds of buyers. After much brainstorming, we decided to call them what they are: *special-function servers*.

These products from Castelle, Hewlett-Packard, Intel, and Microtest attach to a network cable and make printers available to the client PCs. They use Novell software and don't require any other hardware. Intel's NetPort Print Server and Microtest's LANport and LANport II also have varying

capabilities to act as communications servers. The size of the Intel and Microtest units—about as big as a VHS videotape cartridge—allows you to place them with their attached printers or modems on any table or rollaway printer stand. Castelle's LANpress and the HP 33480A LAN connection, which are slightly larger, also tuck away nicely in any office environment. With list prices ranging from about \$500 to \$1,000, several of these special-function servers give you an affordable alternative to using a PC as a print or communications server.

We had these products installed for weeks at PC LAN Labs, and we



like them. Network administrators will find them easy to install and use; the Microtest and Intel special-function servers provide particularly good economy.

The processors in these devices—often Motorola and Intel CPUs—use software contained in read-only memory. They don't need attached monitors, drives, or keyboards. Special-function servers typically use print server software running on a NetWare file server to receive and store print jobs; they then take those jobs from the queue and pass them to their attached printers. This architecture moves the print job over the cable at least twice—something purists will moan over. But the practicality and value of these servers offer a good trade-off.

While the initial versions of these products worked only on the IEEE 802.3 Ethernet cabling scheme under NetWare, later versions allow various Token-Ring combinations. They currently do not work with DOS-based LAN operating systems such as Artisoft's *LANtastic*, however.

One related product, LansPrint from Digital Products, will work with any cabling scheme under *NetWare*. Unlike the special-function servers in our reviews, LansPrint isn't a standalone unit; it works inside a PC to improve the throughput of print jobs (see the sidebar "LansPrint: Taking the Burden Off the CPU").

SERVICES OF THREE TYPES

Although you typically think of a network server as a piece of hardware, the term *server* is actually the functional description of a role determined by software. Software running in a networked computer lets it act as a file server, communications server, or print server.

File servers, as the name implies, let client PCs share files on their hard disks over the network. We provided information on the design and fine-tuning of these systems in our LAN Survival Guide issue (*PC Magazine*, May 29, 1990) and in our comparison of *NetWare 386* and *LAN Manager 2.0* ("Networking in the '90s," December 11, 1990).

Print servers make printers available for shared use. Most allow users to share up to five printers. Print server software stores incoming jobs in a file called a *print spool* on a hard disk, where they wait in a queue for an available printer.

The drive that holds the print spool could be on another PC acting as a file server, but this arrangement puts a lot of traffic on the network. Print jobs must

move from the PC running the application through the print server to the spool on the file server, and eventually back to the print server for printing.

Network administrators commonly locate the print server and file server functions together inside the same PC. On the other hand, Novell's *Advanced NetWare 286*, Version 2.15c, and *NetWare 386*, Version 3.0, allow you to establish remote print servers. Novell provides a Value Added Process (VAP) for *Advanced NetWare 286* or a *NetWare Loadable Module (NLM)* for *NetWare 386* to run in the file server. These software modules redirect the print jobs from specific queues to designated remote printers. The VAP isn't widely used because the print service it provides is slow and sometimes unreliable, but the *NetWare 386 NLM* works well.

NetWare provides utilities for both dedicated and nondedicated print servers.



EDITOR'S CHOICE

• LANpress

It's hard to argue about a cost-effective server that looks good, includes excellent software, and connects to as many as four printers or plotters. Castle's LANpress outscored its competition in this head-to-head comparison.

The LANpress provides four ports for printers and both AUI and BNC ports for LAN connections. The software retains the look and feel of *NetWare* and provides an intuitive way to attach printers.

Intel's NetPort Printer Server, selected (with Microtest's LANport) as one reviewer's personal Best of 1990 product in this issue, will appeal to many people because of the company's reputation and widespread support. And the NetPort will probably be available through mail-order channels with deeper discounts than the LANpress, so it certainly deserves the close attention of anyone buying a special-function server. But the flexible installation and expansion of the LANpress justifies spending a few more dollars up front. ■

The PSERVER.EXE program runs in the DOS environment on a dedicated PC, while PSERVER.VAP and PSERVER.NLM run on *NetWare* file servers. All work basically the same way. The computer running PSERVER takes print jobs from the queues of up to 8 file servers and sends them to as many as 16 printers attached locally and to nondedicated print servers.

At the same time, the nondedicated print servers run a TSR called RPRINTER.EXE, which allows the computer running PSERVER to route jobs to either of the remote servers' two attached printers. RPRINTER.EXE lets you place shared printers anywhere there is a networked PC, but that PC pays a price. As the print jobs move through the network adapter and on to the printers, the PC's CPU receives a constant stream of interrupts. Depending on the number and size of the jobs and the type of PC, the CPU can dedicate 40 to 50 percent of its processing power to servicing the printers. Anyone using the PC for local applications will experience slow screen updates and slow performance on CPU-intensive tasks.

The phrase *communications server* covers a variety of tasks. Communications servers can act as gateways to mainframe computers, allowing client PCs to share a costly mainframe communications channel. They can make pools of expensive high-speed modems available for sharing on a first-come-first-served basis. And they can run software like Action Technologies' *Message Handling Service (MHS)*, which is able to link different electronic mail systems.

A network *modem server* is a specific subcategory of communications server. A modem server makes a group of modems—often as many as four—available to the client workstations. People at the client stations use software that can communicate across the network, such as DCA *Crosstalk Mk.4*, to establish a dedicated connection to a modem in the pool. Unlike the print server, which buffers the tasks going to the printers, the communications software running in the client PC and the modem needs a real-time connection. The modem server gives the first PC to win its services its full attention for the duration of the call, creating a condition known as a *virtual circuit*. The Intel and Microtest products can establish virtual circuit connections for modems attached to their serial ports.

An *access server* is a type of communi-

CONNECTIVITY

SPECIAL-FUNCTION SERVERS

cations server that operates in the other direction. Instead of using the clustered modems to dial out, people call into the access server to use the resources of the network. Typically, an access server consists of specialized, complex, and dedicated hardware and software. But Microtest's LANport II can act as a limited-capability access server. One person at a time can call into each LANport II and perform tasks such as file transfers.

Networking software products such as *LANtastic* allow any networked PC running DOS to act in any or all of these server roles and still run application programs. Microsoft's *LAN Manager* gives the same abilities to OS/2-based PCs. Novell's popular *NetWare* operating system lets you combine file server and print server functions in the same PC or establish separate print servers. PCs acting as *NetWare* file servers can't run applications, but the print server software can reside in a PC that runs applications. Under *NetWare*, comm server software usually runs in a dedicated PC.

PLACING THE SERVERS

The biggest advantage of designing a network with separate print servers is the ability to arrange the geography of the network to suit the users. If you combine the print server and file server functions into a single server—without allowing any remote print servers—you have to locate the shared printers close to the server hardware, primarily because of distance limitations on parallel port connections. Since the PC acting as a file server for a robust network has many noisy hard disks, powerful fans, and probably a bulky uninterruptible power supply, it's usually consigned to a remote location—perhaps even behind a locked door for security. You'll have to plan carefully to find a location suitable for the file server hardware and convenient for people trying to retrieve print jobs.

Sharing printers through conveniently located personal workstations may seem like a good solution to the problem. The idea of using a PC simultaneously as a print server and as a personal workstation definitely has appeal, but it also has practical limitations. You can only slice a PC so many ways until the people at client stations and the person using the machine locally all receive slow service.

Hardware interrupts generated by serial and parallel port activity and client workstations' concurrent requests for

access to the hard disk can slow down even the fastest 386-based PC. As the number of print jobs builds and the complexity of application programs increases, only people running lightweight programs find it practical to contribute printer services to the network through their PCs. To avoid these headaches, many network administrators set up dedicated PCs as print servers in convenient locations around the office. But this architecture takes space and requires the full resources of a PC and hard disk for each print server.

For communications servers, the major consideration isn't geometry; you can set them anywhere you have a phone line. The major consideration is CPU power since communications servers must provide real-time connections.

Handling the hardware interrupts generated by the serial ports keeps the CPU in a communications server even busier than the one in a print server. Few people will enjoy running application programs on a PC that simultaneously functions as a communications server. Under this kind of a load, characters appear on the screen long after you type them, and screen scrolling can take minutes. So in today's typical network, communications server software usually runs on a separate dedicated PC.

REVIEW CRITERIA

For this review, we compared five external printer- and communications-server devices that attach to a network cable and don't require any other hardware. The newly arrived LansPrint doesn't fit into this category, so we evaluate it in a separate sidebar (without comparing it with



SPECIAL-FUNCTION SERVERS: SUITABILITY TO TASK

Special-function servers replace dedicated PCs for managing printer and modem functions. To be of value, they should perform the tasks of traditional servers and make the peripherals more convenient to use.

These suitability-to-task charts provide a subjective rating of the separate abilities of print and modem servers. Compare them with the reviews and the attributes listed in our features table for a complete picture of the products.

PRINT SERVER TASKS

Installation and operation means the printers can be installed where people can easily get at them, anywhere on the network. Important characteristics in this context include ease of installation, functionality, and value.

Products scoring well in the area of **flexible connections** allow the simultaneous connection and management of several types of printers or plotters. The more ports and types of network connections the server has, the more flexible its connection possibilities.

MODEM SERVER TASKS

Modem pooling allows network client stations to access one of several modems attached to a server for outgoing calls on

a first-come-first-served basis. In evaluating a machine's qualifications for this task, we are looking for easy installation by the network administrator and easy use by people with little technical expertise.

Remote access means that users at remote stations can call in to the network and gain use of its resources. A product with a high score in this area is easy for the network manager to install and easy for callers to use.

LAN application access is a measure of how readily the remote user can run application programs using network resources. The product should use data and program files on the network efficiently and economically.

THE RATINGS

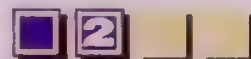
0—poorly suited to the task



1—adequate for the task



2—good



3—very good



4—excellent for the task



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"...the machine could reliably handle everything I piled onto it." "The systems from ACMA Computer, Inc. inspire confidence." "Clearly, ACMA intends to be competitive, not only in terms of system bang for the buck, but also in the realm of intangibles like technical support and product warranty." (April & July 1990)



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- 2 serial, 1 parallel & 1 game ports
- 101 Enhanced keyboard
- MS-DOS 3.3 or 4.01
- Two year warranty*

\$1,995

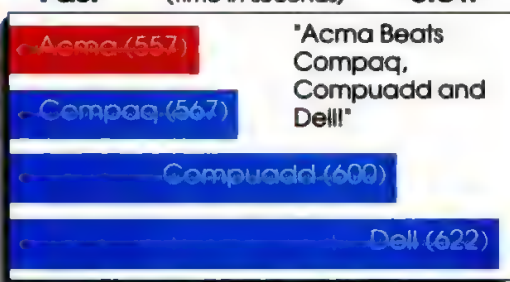
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the others in our features table and suitability-to-task ratings).

Small and flexible beats big and bulky in almost every context, and LAN servers are no exception. These wily special servers will become a favorite solution for the printing and modem problems of many network administrators.



Want to set up a cluster of networked printers for a workgroup? Castelle's \$795 LANpress will do the job (\$1,200 for Token-Ring). Easy to set up and use, this 3-pound special-function print server provides an economical and convenient way to hook up and configure as many as four printers or plotters in one area of your office. Although the LANpress costs more

CONNECTIVITY SPECIAL-FUNCTION SERVERS

than some of its competitors, Castelle's pricing makes sense for installations of multiple printers or plotters.

With its multiple ports and configuration utilities, the LANpress offers a few more features than the other peripheral print servers in our review. While other special-function servers restrict you to sharing two printers on the device, the LANpress lets you share four. With a flick of a switch, you can also choose between thin Ethernet connections and AUI connections for 10BaseT or fiber-optic cable.

The LANpress exterior displays a simple, streamlined facade, but don't let it fool you. Inside the sleek cabinet, a powerful and specially designed print server processes print jobs from the Novell print queue. The special firmware includes a Motorola 68332 16-bit CPU processor with its own RAM, and an Ethernet interface that includes all the hardware neces-



sary to let the device replace a PC acting as a print server. The LANpress combines this firmware with network protocol, processing, and interface software so that it can communicate with the file server and client stations on a *NetWare* network. Like competing packages, the LANpress kit comes complete with the documentation and power supply.

MULTIPLE WAYS TO CONFIGURE

Before you install the LANpress, you should read the documentation explaining how to designate the master file server, establish the existing and new print queues

LANSRINT: Taking the Burden Off the CPU

by Kimberly Maxwell

Digital Products' LansPrint offers a slightly different solution to the problem of where to locate networked printers without burdening a PC. With a base price of \$495, the LansPrint software/adaptor card combination relieves the burden by working from inside the machine, rather than as a separate device that you attach to the network cable. While less expensive than most of the products reviewed here, the LansPrint shares with them the ability to move print jobs straight to an attached printer without heavily taxing a PC's CPU.

The LansPrint card sits in a client station or file server and is connected to the computer's network attachment. The LansPrint also comes with a parallel port that attaches directly to the printer. Since it requires only a parallel printer cable, the LansPrint allows you to establish a remote printer connection on any type of network cabling scheme. When you order any of the other products we looked at, you must have a specific type of network cabling in mind.

By routing print jobs from the print queue through the internal board to an attached printer, the LansPrint takes a large part of the data-handling load off

the CPU in the workstation or file server where it resides. Where the CPU might normally spend 40 percent of its energy on printing chores while running other applications, only about 10 percent is needed when the LansPrint is connected.

If your LAN uses networked printers heavily, LansPrint can also speed up network throughput. The software runs as a 20K TSR in the machine where the LansPrint resides. If you load it into the file server, you can load it as a VAP (Value Added Process) on an *Advanced NetWare 286* network. The software is based on *NetWare's* PSERVER VAP and RPRINTER.EXE (the remote print service on which most printer-sharing schemes rely), but because Digital Products has rewritten this software for compatibility with the LansPrint hardware, it doesn't slow down the PC as much. For *NetWare 386* networks, Digital plans to release an NLM (*NetWare* Loadable Module) version for \$495.

You can set up the board in the file server, much the way you would with the PSERVER NLM or VAP, or you can set up the LansPrint on a workstation, similar to the method used with Novell's RPRINTER.EXE. But the LansPrint does not support using Novell's

PSERVER.EXE in a dedicated DOS print server.

The \$495 LansPrint package includes a single-port adapter card and the software needed to use the LansPrint in either a *NetWare* file server or a client station on the network. Digital Products also plans to sell a two-parallel-port version of the internal card for \$695 beginning in February. A \$495 single-port Micro Channel version will be released at the same time. Currently, the package works on computers with XT- or AT-type buses.

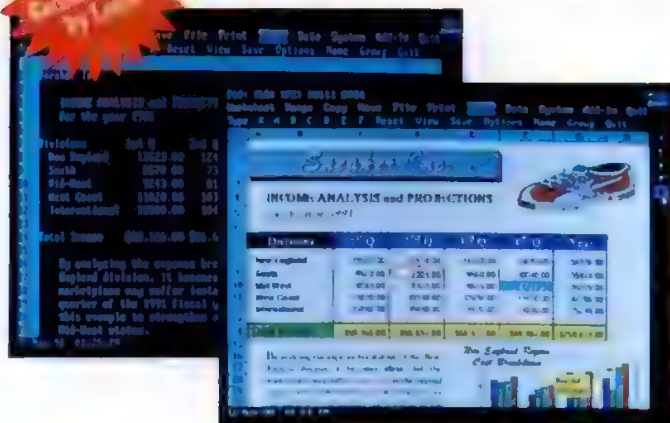
If you use Novell's RPRINTER.EXE, you'll appreciate the LansPrint. It recovers CPU power while providing a less expensive alternative than special-function servers.

LansPrint; Digital Products Inc., 108 Water St., Watertown, MA 02172; (800) 243-2333, (617) 924-1680. **List Price:** With single port for PC-XT/AT bus, \$495. Available February 1991; with single port for MCA bus, \$495; with dual port for PC-XT/AT bus, \$695. **Requires:** IBM XT, AT, or compatible computer; DOS 2.1 or later. For VAP version: *NetWare 286*, Version 2.15 or later. For NLM version (available February 1991): *NetWare 386*, Version 3.0 or later.

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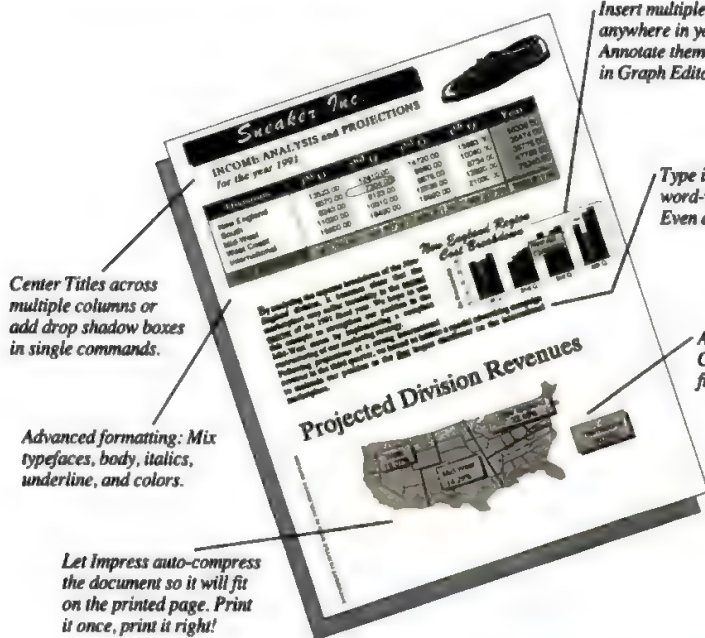
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Yes	No
Yes	No
Yes	No
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The OL400: The Only \$999 Page Printer.

Our 4 ppm OL400, for example, has the lowest list price of any page printer on the market: only \$999.* Yet that price gets you a printer that earned a PC Magazine Editor's Choice Award, with standard features—extra fonts, a full 200-sheet paper tray—that you won't find on a LaserJet® IIP selling for hundreds of dollars more. Plus a slim, low-profile design that's less bulky on a desktop.

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And the OL400 isn't the only Okidata LED page printer to offer outstanding value. For applications where greater speed is needed, the OL800 delivers 8 ppm with all the advantages of the Okidata LED printhead: straight-line paper path, 5-year

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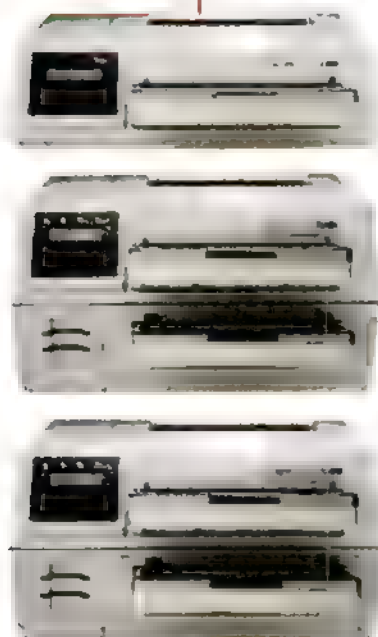
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Okidata OL400





FACT FILE

EDITOR'S CHOICE



LANpress

Castelle, 3255-3 Scott Blvd., Santa Clara, CA 95051; (800) 359-7654, (408) 496-0474.

List Price: Ethernet, \$795; Token-Ring, \$1,200.

Requires: NetWare 286, Version 2.0 or later, or NetWare 386, Version 3.0 or later.

In Short: The LANpress, a slick-looking special-purpose print server in a small 3-pound box, can process print jobs from queues on multiple NetWare servers. Its ability to support up to four connected printers or plotters—and either BNC or AUI connections—provides good economy in large installations. It includes a configuration utility modeled after NetWare's PCONSOLE.

CIRCLE 413 ON READER SERVICE CARD

served by each LANpress port, and decide which file servers will service those queues. The ports can serve multiple queues on up to eight file servers.

You must have supervisor rights in order to run one of the configuration programs. Castelle gives you a choice between two utilities included in the LANpress software. If you are running NetWare 386 or later versions of Advanced NetWare 286, you can set up the device using NetWare's popular PCONSOLE program instead.

One of Castelle's utilities works as a command-line program. The other configuration utility, LPCONSOL, offers a menuing system similar to that of PCONSOLE. Working with LPCONSOL can be like going home to a familiar environment. You can configure printer ports, add or delete a file server from the service list, configure the print queues, and assign passwords. If you're familiar with PCONSOLE, LPCONSOL is a cinch.

After you run the LANpress's 5-minute installation program on any DOS client station, you must attach the printers to the device, plug in the power supply, select the BNC or AUI connector, and connect the network's Ethernet cabling to the LANpress. When you connect a serial printer to the LANpress's serial ports, you must set the printer defaults to match the LANpress defaults. You need to reboot the device every time you change the port parameters or the configuration of the device. Since it is not equipped with an on/off switch, you have to unplug the power supply to reboot it.

CONNECTIVITY

SPECIAL-FUNCTION SERVERS

DETAILED REPORT CAPABILITIES

Two indicator lights show the device's status. When the lights finish blinking and the green light remains on, you can begin using LANpress. Each time we turned it on, the unit spooled a Power On Configuration Report to the printer for our review. The report shows detailed information regarding serial and parallel port configurations, along with the baud rate. It also gives a list of the file servers on the network and the available print queues. LANpress prints a cover sheet before each print job, exactly like a standard Novell print server.

Castelle provides a 90-day warranty and free technical support at a toll-free number. If you're searching for a solution with the look and feel of the utilities you use in NetWare, with the possibility of multiple parallel and serial ports, then you need to look at the LANpress. It makes printing convenient for network users and makes controlling print jobs a breeze for the LAN administrator.

HEWLETT-PACKARD CO.

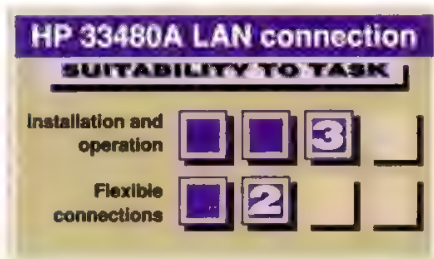
HP 33480A

LAN connection

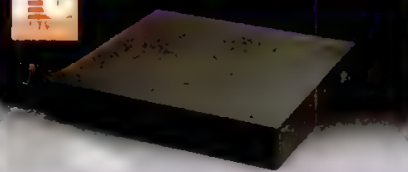
by Randol Tigrett

Hewlett-Packard offers a way to put a LaserJet printer in a convenient location on the Ethernet cable in any network using Novell's NetWare. For \$949, you can buy the HP 33480A LAN connection to relieve the pain of walking a mile to get a hard copy of a report. The HP 33480A is easy to install and works well, but the Ethernet version carries a steep price tag relative to the competition; it allows only a single printer connection. The Token-Ring version, although more expensive (\$995), comes closer to being a good buy.

The HP 33480A measures just the right size to fit under a LaserJet. The unit weighs about 10 pounds and offers a parallel connection supporting one of four models of



FACT FILE



HP 33480A LAN connection

Hewlett-Packard Co., 300 Hanover St., Palo Alto, CA 94304; (800) 752-0900.

List Price: Ethernet, \$949; Token-Ring, \$995.

Requires: NetWare Print Server, Version 1.2 or later; NetWare 286 (Advanced NetWare 286 or SFT NetWare 286, Version 2.15c) or NetWare 386.

In Short: This unit works with just four models of Hewlett-Packard printers on a NetWare network, and since it contains one parallel and no serial ports, it can support only one printer at a time. Despite exemplary documentation, the technology is too simple and the printer support too limited to justify the price tag, particularly for the Ethernet model.

CIRCLE 414 ON READER SERVICE CARD

HP LaserJet printers. If you have a LaserJet Series II, IID, III, or 2000, you'll be able to use this product, but it will drive only one printer connection.

LITTLE ASSEMBLY REQUIRED

The HP 33480A comes ready to run on a network under NetWare. The Ethernet version supports either thick or thin cabling, and the Token-Ring version can use shielded or unshielded twisted-pair wire. A small package shipped with the HP 33480A contains fuses and fuse holders that let you set the voltage to run the unit, even on European line voltage.

Software installation is remarkably easy. The software loads onto the public directory of the default LAN server. After using Novell's PCONSOLE to create a new print server or to select an existing print server or print queue, you can use HP's PREMOT utility to finish the installation. PREMOT makes the virtual connections between the designated print queue on the file server and the HP print server. Interface software lets you check the status of the printer and print job from your desk.

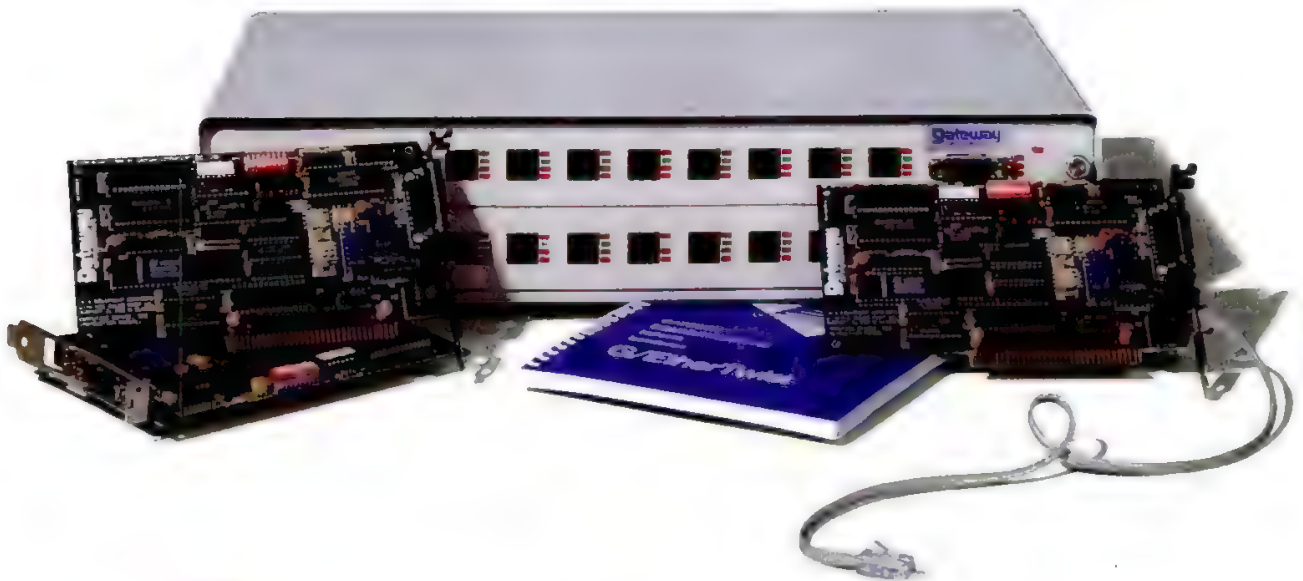
The HP's best feature is the documentation. Other companies should read HP's book and use it as a guideline for their own manuals. The administrator's manual includes examples on setting up the LaserJet for graphics or PostScript.

COST COMPARISONS

Before you buy the HP solution, ferret out a dusty old IBM PC and open it up. You



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CIRCLE 146 ON READER SERVICE CARD



FaceLift

(Bitstream)

Bitstream Facelift is an enhancement product for Microsoft Windows 3.0 and 2.X that makes high-quality screen and printer fonts instantly and easily. Features include: scalable typefaces, point size that is only limited to application, true WYSIWYG, high quality dot matrix laser printer and PostScript output. Also available is Bitstream Facelift for WordPerfect (for laser printers only.) \$58 ea.



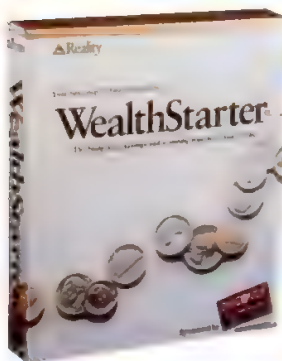
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(Corel Systems)

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(Lynx)

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(Insight Development)

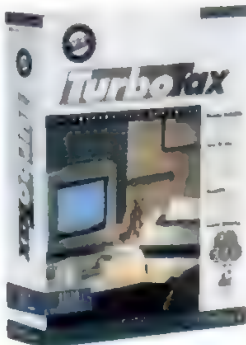
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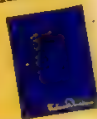
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Foresight Resources	
★ Drafix Windows CAD 3.0	435.
DrafixCAD Ultra	243.
Generic Software	
AutoConvert 4.0	243.
Basic Home Design	31.
Generic CADD 3D Drafting 1.1	179.
Generic CADD 5.0	235.
Generic CADD Lvl. 3 w/ Dot Plot	209.
Grolier	
Electronic Encyclopedia	219.
Mathsoft	
Mathcad 2.5	293.
Summagraphics	
Summasketch II w/ 4 button	399.

BUSINESS

Abacus	
★ Becker Tools	45.
Above Software	
Above Disk 3.0	59.
Above Mem	41.
Absolute Solutions	
★ Computerized Classic Acct.	209.
Access Software	
Prompt	74.
Advanced Software	
Docucomp	109.
Alpha Software	
Alpha 4	299.
Applause Software	
The Perfect Addition	29.
The Perfect Addition III	29.
asd Software, Inc.	
★ Planisoft	139.
Ashton Tate	
Control Room	72.
dBASE IV 1.1	489.
dBASE IV Developer's Toolkit	830.
dBASE IV LAN Pack	638.
Framework III 1.1	449.



TaxCut

(MECA) This tax season, prepare an expert-quality tax return on your PC with TaxCut. Expert help is available every step of the way and TaxCut won't let you quit until your returns are complete and accurate. \$55.

PC Artifax

(Metro Software Inc.)

Introducing the revolutionary new laser fax! Transform your ordinary faxes into extraordinary, sharp faxes with PC Artifax, an amazing new faxboard utility program. By converting your documents into a Hewlett Packard format, you can create, print or fax spectacular letters, spreadsheets, or newsletters in any application with all the fonts, graphics, forms or logos possible on an HP laser without even owning a laser printer. \$69.



Ashton Tate	
Applause II	49.
Draw Applause 1.1	289.
Master Graphics Presentation	288.
AutoDesk	
★ AutoDesk Animator	229.
Avery	
Label Pro Dot Matrix	49.
Bistream	
Collections	155.
★ FaceLift for Windows	58.
FaceLift for WordPerfect	58.
Headlines	95.
Bourbaki Inc.	
Fractool	29.
Brightbill-Roberts	
Show Partner F/X 3.5	224.
Broderbund	
New Printshop	35.
New Printshop Companion	29.
Caere Corporation	
Omnipage 2.1 386	595.
Corel Systems	
★ CorelDRAW! 1.2	319.
Custom Applications	
Freedom of Press	249.
Freedom of Press Light	New.
Digital Research	
GEM Artline	405.
GEM Desktop Publisher 2.1	169.
GEM Graph	169.
Dunn Systems	
Artclips for Toolbook	99.
Electronic Arts	
Deluxe Paint II Enhanced	76.
Fox Software	
Fox Graph	174.
Good Software	
Arriba	103.

Power Up Software	
Express Publisher 2.0	83.
Samna	
★ Ami Professional 1.2	305.
Software Publishing	
Art Gallery	84.
Harvard Graphics 2.3	329.
Harvard Graphics LAN Pak 1	1095.
First Publisher 3.0 w/Deluxe Paint	95.
Screenshow Utilities	98.
Springboard	
The Newsroom Pro 1.0	23.
Sumak Enterprises	
Quick Graph	70.
Systat	
Sygraph 1.1	439.
Three D Graphics	
Perspective Jr.	74.
Timeworks	
Publish-It! 1.2	125.
Publish-It Lite!	33.
T/Maker	
ClickArt Business Cartoons	42.
ClickArt Business Images	42.
ClickArt Christian Images	42.
ClickArt EPS (various)	80.
ClickArt Personal Graphics	42.
Unison World	
Avagio	169.
WordPerfect	
DrawPerfect	269.
Xerox	
Gray F/X	305.
Ventura Publisher 2.0	509.
Ventura Pub. Gold Series 3.0	549.
Xerox Graph 1.0	195.
Zenographics	
Pixie 2.0	165.
Z-Soft	
PC Paintbrush IV for Windows	84.



Double Disk

(Vertsoft) Double the capacity of your hard disk. Double Disk is a unique utility that eliminates the need to purchase a larger hard disk by using software only. \$60.

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Multimate 4.0	291.
Ask Sam Systems	
askSam 4.2	159.
Atech/M	
★ Publisher's Power Pak	
for Windows	45.
Automated Design Systems	
★ Windows Workstation	535.
Avery	
LabelPro	49.
List & Mail Plus	38.
Bell Atlantic Corp.	
★ Thinx	305.
Better Software Technologies	
★ Switch-It	71.
Bloc Publishing	
Dan Bricklin's Page	59.
Form Filler 3.0	84.
Form Tool Gold	56.
Personal Lawyer 2.0	37.



Play It By Ear

(Ibis Software) Learn to recognize intervals, scales and chords with Play It By Ear. It plays melodic and harmonic exercises and relates sounds to their keyboard and guitar equivalents, so that you can start playing music "by ear." \$61.

Blythe Software	
Omnis 5	499.
Borland International	
Paradox 3.0	529.
Paradox 386	569.
Reflex	169.
SuperKey 1.1	65.
Quattro Pro 2.0	319.
Quattro Pro LAN Pack User	199.
Brightbill	
RobertsHyperPAD 2.0	83.
Broderbund	
BannerMania	21.
★ Dragnet	82.
MemoryMate 3.01R	38.
★ Prompt	74.
CE Software	
Quickmail 2.2	59.
Quickmail 5-user	189.
Central Point Software	
Central Point Backup	59.
Copy II PC 6.0	22.
PC Tools Deluxe 6.0	85.
Checkfree Technologies	
Checkfree Express 2.0	19.
Chronologic Corp.	
Instant Recall	64.
Chronos	
Who What When 2.0	175.
Clarion Software	
Report Writer	119.
Compuserve	
Compuserve Info Service	21.



System Sleuth

(Dariana Technology) Determine your system's configuration and identify system conflicts with System Sleuth. Identify hardware/software incompatibilities, resolve conflicts between TSRs and much more. \$83.

Contact Software Intl	
ACT! 2.0	229.
Core International	
CoreFast 2.0	75.
Corvus	
Ready Net Add-On Kit	164.
Ready Net Start-Up Kit	324.
Crosstalk Communications	
Crosstalk Communicator	55.
Crosstalk XVI 3.71	104.
★ Crosstalk for Windows 1.1	117.
Remote 2.0	107.
Dac Software	
Dac Easy Accounting 3.0	79.
Dac Easy Accounting 4.1	79.
Dac Easy Bonus Pak 4.1	159.
Dac Easy Light	39.
Dac Easy Payroll 4.1	59.
Lucid 3-D 2.0	55.
Lordodex Live	29.
Dariana Technology	
System Sleuth	83.
★ Win Sleuth	83.
Datastorm Tech.	
Hot Wire	68.
Procomm Plus 1.1	70.
Procomm Plus Netwk. Wk. Station	39.
Procomm Plus Network 1.05 Pak	345.
Delrina Technologies	
PerFORM 2.1 (w/Rebate)	159.
PerFORM Filler 2.0	75.
PerFORM Filler LAN	332.
★ PerFORM PRO	279.
Delta Technology	
Direct Access 5.0	59.
Extra	54.
Describe Inc.	
386 Accelerator Describe	405.
Describe for OS/2	409.
Digital Composition Systems	
dbPublisher Professional	399.
Digital Research	
Gem Wordchart	109.
Dolphin Software	
Perfect Presentation	89.
Dow Jones & Co.	
Dow Jones News/Retrieval Kit	19.



Definitions Plus!

(WordScience) The electronic version of the 795 page American Heritage Dictionary from Houghton Mifflin. Helps you write better, faster; enhances word processing productivity. Pops up inside character based word processors, spellcheckers and thesauruses. \$65.

Market Analyzer 2.0	189.
Market Analyzer Plus	242.
Market Manager Plus Prof.	269.
Spreadsheet Link	13.
Dynamic Microprocessor Assoc.	
pcAnywhere IV	99.
Easysoft	
Dos Partner	49.
Enable Software	
Enable 5 Pack Workstation	1215.
Enable BP	119.
Famware	
Family Fortune	39.
Family Reunion	39.
Fifth Generation	
Brooklyn Bridge 3.0	82.
Fastback Plus 2.10	115.
Mace Utilities 1990	85.
FinalSoft	
Translate	334.
Fischer	
Watchdog	170.
FormalSoft	
ProCube 1.03	59.
FormGen Corp.	
FormGen Plus 5.0	139.
Formworx Corp.	
★ Form Publisher for Windows	139.
Formworx 2.5	39.



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(Centra) Feel the suspense filled action of casino gambling while learning and practicing at your own pace. nsk free. Casino Master combines five casino games into one package. Blackjack Ace, CrapsMaster, RouletteMaster, PokerMaster and BacaratMaster. \$41.

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Fox Software	
Foxbase + 2.1 Network Pack	284.
Foxbase + 2.1 Runtime Module	249.
FoxPro	479.
FoxPro LAN	649.
FoxPro Unlimited Runtime	279.
Funk Software	
Always 1.2	105.
Always for Symphony	79.
P.D. Queue	54.
Sideways 3.21	37.
Gazelle Systems	
Back II LAN 4.0	210.
GeoWorks	
GeoWorks Ensemble	109.
Gibson Research	
Spinrite II 1.1	65.
Great American Software	
Money Matters	51.
★ FirstApps	49.
★ Windows Express	49.
Hayes	
Smartcom III	138.
SmartCom Executive	75.
Helix	
Headroom 2.03	72.
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Hewlett Packard	
New Wave 3.0	160.
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Quicken 4.0	35.
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Jacoby & Meyers Law Offices	
WillPower	29.
Lattice, Inc.	
Lattice C 6.0	155.
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TotalWord	265.
Logitech	
Catchword	135.
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Ronstadt's Financials	99.
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★ Lotus 1-2-3 Rel. 3.1	399.
Lotus 1-2-3 3.1	419.
Lotus Works	92.
Magellan 2.0	109.
Metro	59.
Symphony 2.2	529.
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AutoMenu	33.

Meca	
Checkwrite Plus	29.
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Managing Your Money 6.0	122.
Merril & Bryan	
InfoSpotter	50.
★ Turbo EMS 5.0	49.
Metro Software	
LaserTwin All In One 2.09	112.
LaserTwin for Canon LBP 8-III	112.
PC Artifax	69.
Microcom	
Carbon Copy Autopilot	59.
Carbon Copy Plus 5.22	115.
Virex PC	72.
Micro Logic	
InfoSelect	Call.
More Fonts	89.
Microlytics	
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Wordfinder 4.0	33.
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R:Base Compiler	605.
R:Base for DOS 3.1	161.
Microsoft	
Excel for OS/2 2.2	319.
Excel Node	159.
★ Excel for Windows 2.1C	309.
★ License Pack Excel	
For Windows	299.
★ License Pack PowerPoint	
For Windows	299.
★ License Pack Word	
For Windows	299.
★ Productivity Pack	42.
★ Project for Windows 1.0	459.
★ Windows 3.0	88.
★ Windows Developer's Tool Kit	319.
Word 5.0	209.
★ Word for Windows 1.1	319.
Works 2.0	95.
Monogram	
Dollars & Sense 3.1	99.



HyperACCESS/5

(Hilgraeve Inc.) Step up to HyperACCESS/5, the award winning async communications program. Fastest file transfers, virus protection, automated scripting, remote control and more. "Must have" John C. Dvorak, "Editors Choice" PC Magazine. \$125.

Multisoft	
PC-Kwik Power Pak 1.5	70.
Super PC-Kwik 3.3	49.
MySoftware Co.	
MyAdvancedMailList	28.
MyCheckbook	14.
MyLabelMaker	14.
NBI, Inc.	
★ Legacy	285.
Nolo Press	
For the Record	29.
Willmaker 4.0	36.
Norton Lambert	
Close Up Customer/Terminal	119.
Close Up Support/ASC 3.0	154.
On The Go Software	
Expense-IT!	82.
Owl International	
Guide	185.
Owl Guide 3	379.
PC Publishing	
Impress 2.0	74.
Peachtree Software	
Peachtree Complete III	145.
Peachtree Cmpl. III Bonus Bde	219.
Personics	
@Base Symphony 2.2	108.
Look & Link 1.1	55.
SeeMore for Symphony	57.
Pop Computer Products	
Reminders!	22.



PC Proof

(Lezexpertise) PC Proof is text-revision software that proofreads documents for potential errors in writing style and word usage. Shows potential errors, updates the original, make corrections instantly and more. **\$89.**

Hard Drive Overlord	40.
Power Up Software	
Address Book Plus Sr.	69.
Calendar Creator Plus	39.
Labels Unlimited	39.
Monarch 1.0	305.
Name That Disk	32.
Quick Schedule Plus 3.1	47.
Top Priority	58.
Working Hours	56.
Precision Software	
★ Superbase 2 Windows	164.
★ Superbase 4 Windows	439.
Prime Solutions	
Disk Technician Advanced 6.0	88.
Primetime Software	
Primetime Personal	68.
Prisma Software	
★ Your Way	113.
Prodigy	
Prodigy Start Up Kit	29.
Que Software	
RightWriter	55.
QMS	
★ Ultrascript PC 2.1	119.
★ Ultrascript PC Plus 2.1	249.
Qualitas	
386Max Professional	75.
Blue MAX (Mem Mgr) for PS/2	79.
Quarterdeck Office Sys.	
DESQview 2.3	69.
DESQview 386 5.1	119.
QEMM 50/60 5.1	59.
QEMM 386 5.1	55.
QRAM	45.
Reality Technologies	
Wealthbuilder 1.1 (by MoneyMag.)	139.
WealthStarter	
.....	44.
Reference Software	
Grammatik IV 1.0	49.
★ Grammatik Windows	49.
Revolution Software	
Cruse Control	32.
VGA Dimmer	19.
Richmond Software	
Maximizer 2.0	162.
Rightsoft	
Rightwriter 4.0	55.
Rinearson Support Assoc.	
Microsoft Word Companion Disk	29.
Round Lake Publishing	
Letterworks	49.

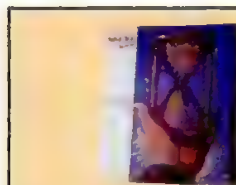
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Sales Letterworks	49.
Roykore	
ABC Flowchart 1.1	185.
Rupp Corporation	
FastLynx 1.01	119.
Samna	
★ Ami 1.2	125.
Sitka	
Inbox/DOS Administrator	199.
Inbox Plus Mac/PC 100-User	610.
TOPS 3.0 Network Bundle DOS	286.
TOPS FlashCard	148.
SoftKlone	
Mirror 111 2.0	82.
Softlogic Solutions	
Cubit 3.0	39.
Disk Optimizer 4.05	39.

Toolworks	
Lengthwise	24.
Toolworks Office Manager	29.
Touchstone	
Check It! 2.1	85.
Traveling Software	
Battery Watch II 2.0	29.
Desk-Link 2.21	99.
Laplink III	89.
Unison World	
Chain of Command	85.
VSoft	
Ready, Aim, FILE!	39.
Verisoft	
Double Disk	60.
Visionary Software	
Synchronicity 2.0	36.



Fat Cat	74.
Software Carousel 3.01	55.
Softshell Systems	
Softbreeze 3.0	99.
Softview	
★ if:X Business Expense Reports	49.
Software Directions	
Print Q 5.0	74.
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Symantec	
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Norton Commander 3.0	95.



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(PrimeTime Software) Now, better than ever PrimeTime runs as a 7K TSR, includes searching and graphical week view, still supports laptops and has its own Sharp Wizard! link **\$68.**

Norton Util. Advanced 5.0	119.
Q & A 3.0	219.
The Norton Backup 1.0	95.
Think Tank 2.41	129.
Systat	
Systat 4.1	529.
Timeslips Corp.	
PercentEdge 1.0	65.
Timeslips III 4.0	165.
Timeslips III Network Edit.	389.
Timeslips Speller	56.

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Westlake Value Pak	64.
Wolfram Research	
Mathematica	575.
WordPerfect Corp.	
LetterPerfect	127.
WordPerfect 5.1	249.
WordPerfect 5.1 Ntwk. Bundle	249.
WordPerfect 5.1 Ntwk. Node	159.
WordScience	
Definitions Plus	65.
WordStar U.S.A.	
WordStar 2000 Plus Pers. Rel.3	269.
WordStar 6.0	256.
Xerox	
Formbase	324.
XTree Company	
XTree Net Adv	275.
XTree Net Els	139.
XTree Pro Gold	79.
Zenographics	
Superprint for HP Laser	114.

TAX SOFTWARE

Chipsoft	
TurboTax Personal 1040	24.
Turbo Tax Personal 1040 8.0	49.
Turbo Tax Pro Series 1120	229.
DacSoftware	
Sylvia Porter's Rapid Tax	42.
MECA	
TaxCut	55.



Win Sleuth

(Dariana Technologies) Win Sleuth, a diagnostic software package for Windows 3.0, features System Info/Drive Info, Windows Task List, memory Usage/Availability per task and more. **\$83.**

Simon & Schuster	
J.K. Lasser Tax Advantage 1990	25.
Softview	
★ MacInTax for Windows	67.

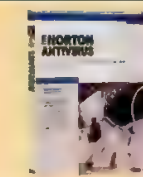
LANGUAGES

Asymetrix	
Toolbook	299.
Bloc Publishing	
Pop Drop Plus	56.
Borland International	
Turbo Assembler Debugger	95.
Turbo C++	135.
Turbo C Prof. ++	170.
Turbo Editor Toolbox 4.0	65.
Turbo Pascal 5.5	98.
Turbo Pascal Prof. 2nd Edition	164.
Clarion Software	
Personal Dev. System	47.
Professional Dev. System 2.1	499.
Command Technology Co.	
SPF/PC 2.1	146.
Harvard Associates	
PC Logo 3.0	68.
Lattice, Inc.	
Lattice C 6.0	155.
Microsoft	
C Compiler 6.0	319.
Cobol 3.0	545.
Macro Assembler 5.1	94.
Quickbasic 4.5	65.
QuickC 2.5	63.
QuickPascal	65.
Nantucket	
Clipper	499.
Solution Systems	
Brief 3.0 for OS/2	159.
Brief 3.0 for DOS	159.
Spinnaker Software	
Spinnaker Plus	285.
Symantec	
Norton Editor 1.3	47.
WYSIWYG	
The Universal Word	118.

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won't find a lot of differences between the HP 33480A and an old PC's innards. Both machines contain an 8088 processor on a spacious motherboard. The major difference consists in the HP firmware on the

CONNECTIVITY SPECIAL-FUNCTION SERVERS

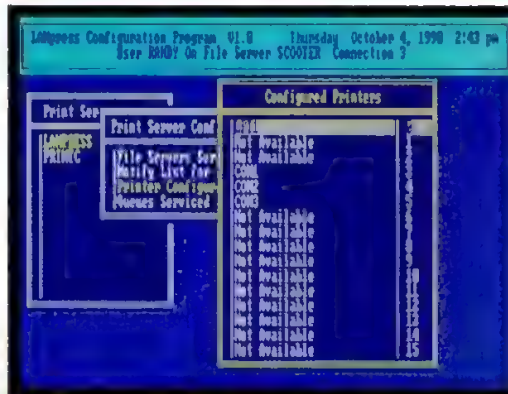
board, which lets you configure the remote HP 33480A as a print server. And of course the unit's cabinet makes a nice

pedestal for the HP LaserJet.

HP's products always offer quality, but you'll spend less money for a print server by choosing a PC with an Ethernet adapter from the back of this magazine.

SPECIAL-FUNCTION SERVER SOFTWARE: The Look of PCONSOLE

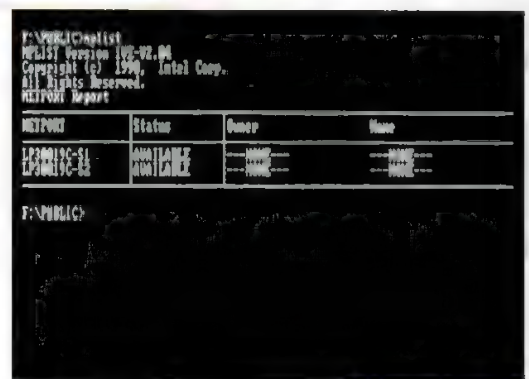
Many of the configuration and menuing programs for special-function servers are designed for users familiar with Novell's *NetWare*. Because many LAN administrators use the PCONSOLE program included with *NetWare 386* and later versions of *Advanced NetWare 286*, the server software often uses the same interface as PCONSOLE or works hand in hand with it. Such software makes a special-function print or communications server seem a more natural part of a *NetWare* environment.



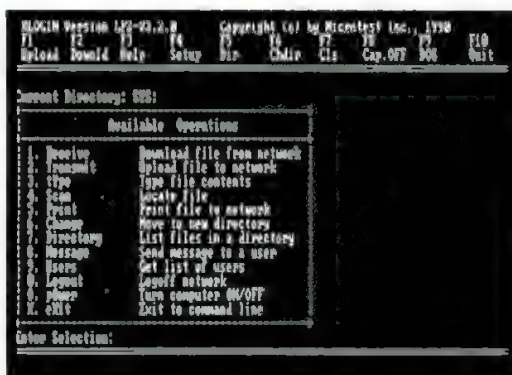
The LANpress configuration program provides full information on all networked printers. You can see and make assignments linking printers and print queues throughout the network.



The HP 33480A LAN connection includes Hewlett-Packard's PREMOT program, which controls the virtual connections between the HP 33480As and the available *NetWare* print servers. Here, the program shows the print server queues and the HP 33480A units on the network.



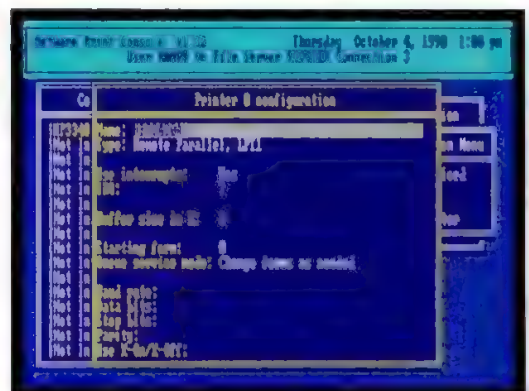
When users call in to Microtest's LANport II on a *NetWare* network, they see the screen shown here. Microtest's RLOGIN program doesn't present a fancy menu, because RLOGIN must work with the communications software the remote user employs for file



transfers. The menu shows up on-screen within any of the different calling programs, but the special function keys along the top may be left out. From this menu, users can select useful network functions, but they can't run applications on the network without additional software.

This screen shows how *NetWare*'s PCONSOLE program recognizes one of the special servers—in this case the HP 33480A LAN connection—as a networked printer. Note how other companies strive to imitate the look and feel of *NetWare*'s utility.

Both Intel's NetPort Print Server and Microtest's LANport provide NPLIST, a simple piece of software that shows the available resources on the server. The printers or plotters attached to either device also show up as resources on *NetWare*'s PCONSOLE.



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Dell System® 316LT	1st	1st	2nd	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
Toshiba T3100SX	2nd	2nd	1st	2nd	2nd	2nd	3rd	2nd	2nd	2nd	2nd	2nd	2nd
Zenith SuperPort SX Model 90	3rd	3rd	3rd	3rd	3rd	3rd	2nd	3rd	3rd	3rd	3rd	3rd	3rd



It wasn't very pretty.

Last July, a computer company from Austin, Texas annihilated the competition in the PC Week Corporate Satisfaction Poll for 386™ SX based laptops.

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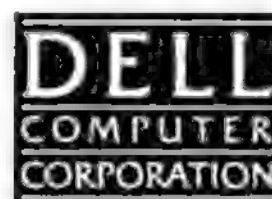
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Remember, *NetWare* comes with the software to establish a remote print server in any PC on the network. Token-Ring adapters still cost more than Ethernet, so the small price differential between the Ethernet and Token-Ring versions of the HP 33480A makes the Token-Ring model a better buy.

HP's one-year warranty protects you against defects in manufacture, while technical support is free at a toll number: (208) 323-2551. After connecting and testing the HP 33480A, we found no difference between printing jobs when a printer was attached to a file server or attached to this unit. The HP 33480A LAN connection gives you flexibility in a good-looking and handy package—at a high-end price.

INTEL PCEO (PERSONAL COMPUTER ENHANCEMENT OPERATION)

NetPort

Print Server

MICROTEST INC.

LANport

by Sara Parker

With the recent release of its NetPort Print Server, Intel's Personal Computer Enhancement Operation throws its hat into the Novell print server arena. The NetPort, which retails for \$695, is identical in size to a VHS videocassette and can replace a PC dedicated to the job of acting as a print server. It allows you to connect up to two printers per device into the LAN wherever the users need them, thus eliminating time-wasting paper chases without monopolizing a valuable PC.

The technology behind the NetPort was originally developed by Microtest, which licensed it to Intel. Microtest offers a similar product, the LANport, which also functions mainly as a printer-sharing

CONNECTIVITY SPECIAL-FUNCTION SERVERS

device. Microtest's pricing varies from \$495 to \$695, depending on the LANport model you choose.

Since Intel is better known than Microtest and is aggressively marketing the NetPort, we'll often refer to the product design as the NetPort throughout this review. The major differences are that Microtest offers LANport models with different serial and parallel port configurations, and Intel's NetPort uses a special EPROM for fast software updates.

The NetPort supplies one parallel and one serial port and is compatible with Ethernet thin-wire networks using *NetWare 2.1x* or *NetWare 386*. You can order the LANport with various combinations of serial and parallel ports and an AUI connector for attachment to 10BaseT, thick Ethernet, or fiber-optic transceivers.

A feature unique to Intel's NetPort is the flash EPROM (erasable programmable read-only memory) that allows you to download software upgrades over the network into the NetPort flash memory, where the EPROM stores the new information. You can upgrade all NetPort servers from a single console.

SETTING UP THE SERVER

One NetPort server supports up to two printers or plotters simultaneously. Because it contains no on/off switch or keyboard, it allows few opportunities for user interruptions. You have three choices when setting up the NetPort on the network. You can set it up as a print server, or as a remote printer, or you can establish a virtual circuit between the NetPort and the client PC.

Installation takes about 5 minutes when you install the NetPort as a print server. You simply connect a serial or parallel printer to the NetPort, copy the software to any workstation, and log on to the network with supervisor rights. The NetPort installation guide shows how to use *NetWare's* PCONSOLE command in conjunction with the NetPort's utility commands.

The NetPort server will configure itself as a remote printer if Novell's PSERVER.NLM or PSERVER.VAP resides on the network. If the NetPort can't find the NLM or VAP, it will activate its own software. Each NetPort server uses one log-on position, and you can have more than 16 printers connected. We used NetPort under *NetWare 386* running

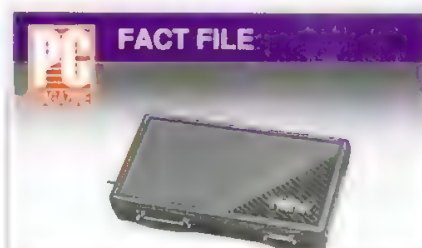
LANport

SUITABILITY TO TASK

Installation and operation	3
Flexible connections	3

PSERVER.NLM, but we had some problems bringing it up under the *Advanced NetWare 286* PSERVER.VAP. You're probably better off using the NetPort software instead of the VAP to set up a remote printer under *Advanced NetWare 286*.

The NetPort rarely needs to function



NetPort Print Server

Intel PCEO (Personal Computer Enhancement Operation), Mail Stop C03-7, 5200 N.E. Elam Young Pkwy., Hillsboro, OR 97124-6497; (800) 538-3373, (503) 629-7000.

List Price: \$695.

Requires: Ethernet thin-wire network complying with 10Base2 standard; *NetWare 286*, Version 2.1 or later.

In Short: Intel's adaptation of Microtest's LANport technology gives LAN administrators an easy, cost-effective way to relocate printers anywhere on an Ethernet/*NetWare* LAN for convenient access. Unlike the LANport, the NetPort comes in a single model with one parallel and one serial port, and it includes a special EPROM for fast software updates.

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LANport

Microtest Inc., 3519 E. Shea Blvd., #134, Phoenix, AZ 85028; (800) 526-9675, (602) 971-6464.

List Price: AUI to LPT1, \$495; AUI to COM1 or COM2, \$595; BNC to LPT1, \$595; BNC to COM1, \$595; BNC to COM1 or COM2, \$695.

Requires: Ethernet thin wire network complying with 10Base2 standard *NetWare 286*, Version 2.1 or later, or *NetWare 386*, Version 3.0 or later.

In Short: Microtest's LANport lacks the "instant software update" feature of Intel's NetPort (an outgrowth of the LANport), but it gives you the choice of various parallel and serial port combinations and either BNC or AUI cable connections. Like the NetPort, it provides an economical way to share printers over a *NetWare* network.

CIRCLE 416 ON READER SERVICE CARD

NetPort Print Server

SUITABILITY TO TASK

Installation and operation	2
Flexible connections	3

HIGHLY RECOMMENDED

When Accounting Today (May 1990) asked accountants which accounting software package they recommended to their small business clients, an overwhelming 29% said they recommend Peachtree Accounting— that's almost double the next largest competitor.

Reseller Management (March 14, 1990) asked resellers which accounting package they recommend and Peachtree came out on top again with 25% of resellers recommending it.

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"It is, I believe, the best accounting package available for the price."—E.J. Bosmeny, CPA, Naperville, IL

"Complete III rivals packages costing 10 times as much."—PC Resource, July 1990

If there's one thing people agree on, it's what a great value Peachtree's Double Bonus Bundle is. That's because it includes two first-rate software packages for one low price—Peachtree Complete III, a full-featured accounting system, and Peachtree Data Query III, a reporting and analysis tool.

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"...It is, beyond a shadow of a doubt, the best, easiest to use, most helpful program I've ever had to review."—C. McQuaid, McQuaid & Holland, Inc., Accountants, Geneva, AL

"Installation is easy, data entry is fast...a joy to use."—PC Resource, July 1990

With Peachtree, you don't have to give up ease of use to get the power and performance you need. The Double Bonus Bundle comes with on-line tutorials for each module and thorough documentation—an Accounting Primer, a quick-start Installation Guide, and a complete reference library—so you can get up and running quickly. Errors are handled with plain English messages and suggestions. Context-sensitive HELP is on-line, all the time.

"I called the Computer Support in my area...and I was very pleased with the immediate response...having reliable support makes all the difference."—Angela Vamianskis, Computerized Accounting and Payroll, Burbank, CA



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CIRCLE 358 ON READER SERVICE CARD

PCM

CONNECTIVITY

SPECIAL-FUNCTION SERVERS

on a network in a virtual circuit, but this mode becomes necessary when you want to set up a printer to work from one workstation only, bypassing network queues. You might need to do this when applications require two-way communications with the printer or plotter, as some CAD packages do. This mode also works for outgoing connections to a modem, but neither Intel nor Microtest stresses modem capability since it is more to set up.

TOP-NOTCH UTILITIES

You get two top-notch utilities to use for monitoring and managing the NetPorts and LANports you have installed. The NPCON utility configures the NetPort options. NPLIST reports information on any or all of the NetPorts on the network. Another utility, a 15K TSR called NPMON, alerts workstations to printer problems. The message gives the serial number of the NetPort serving the printer and the port being used, as well as a description of the problem.

The most useful of the utilities, NPADDR, assigns a valid Ethernet address to an unaddressed NetPort. If you receive the address "ffffff" when requesting an NPLIST, you know your NetPort

**You get two top-notch
utilities for managing
NetPorts and LANports
you have installed.**

has not yet been addressed. NPADDR will automatically address the NetPort for you. This is a feature all PC cards could benefit from. These utilities have slightly different names and implementations in the LANport.

Intel offers a three-year warranty on the NetPort, as well as free, unlimited technical support. Intel's FaxBack, an innovative idea in customer service, gives you immediate access to technical and product information 24 hours a day. The first time you call FaxBack at (800) 525-3019, you can order a catalog of documents for the products you want to know about. After you receive it, you can order the documents by Touch-tone telephone for delivery to your fax machine. The response was prompt for information we requested through this service. Last but not least, support is available through Intel's electronic bulletin board system.

Microtest offers a one-year warranty on the LANport, along with free technical support as well as BBS support. The company will also answer technical questions on CompuServe. Whether you buy an Intel NetPort or a Microtest LANport, you'll have an innovative and economical way to attach printers and plotters at convenient points in your network.

SPECIAL-FUNCTION SERVERS: SUMMARY OF FEATURES

Products listed in alphabetical order by company name

	 Castelle LANpress	 Hewlett-Packard Co. HP 33480A LAN connection	 Intel PCEO NetPort Print Server	 Microtest Inc. LANport	 Microtest Inc. LANport II
List price (Ethernet model)	\$795	\$949	\$695	\$495-\$695	\$695
List price (Token-Ring model)	\$1,200	\$995	N/A*	N/A*	\$1,295
Dimensions (HWD, in inches)	6.5 x 12.3 x 1.6	2.9 x 16.7 x 15.8	1 x 4 x 7.5	1 x 4 x 7.5	1 x 4 x 7.5
Weight (pounds)	3	10	1	0.5	1
HARDWARE PORTS					
Total number of ports	4	1	2	Up to 2	2
Number of serial ports	3	N/A**	1	Up to 2	2
Number of parallel ports	1	1	1	Up to 2	N/A***
FUNCTIONALITY					
Communications support	☐	☐	☒	☒	☒
Plotter support	☒	☐	☒	☒	N/A***
AUI (10BaseT) compatibility	☒	☒ (with HP EtherTwist MAU)	☒ (as of January 1991)	☒	☒
802.3 or Ethernet compatibility	☒	☒	☒	☒	☒
Supports NetWare 386	☒	☒	☒	☒	☒
Supports Novell RPRINTER	☐	☒	☒	☒	N/A***
Novell certification	Pending	☒	☒	☐	☐
SOFTWARE					
Utilities or configuration software included	LPCONSOL	PREMOTE	NPCON	LANport utilities	RSETUP, LP-II utilities
Communications software included	N/A**	N/A**	NP REDIR	LP	RLOGIN
Can be installed using Novell's PCONSOLE	☒	☒	☒	☒	N/A***
CUSTOMER SUPPORT					
Free technical support	☒	☒	☒	☒	☒
Toll-free support line	☒	☐	☐	☒	☒
Warranty period	90 days	1 year	3 years	1 year	1 year

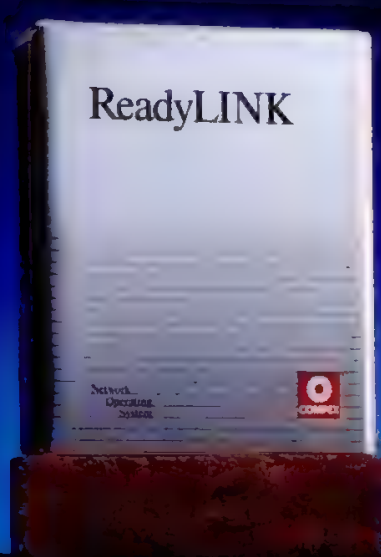
—Editor's Choice ☒—Yes ☐—No

N/A*—Not applicable: This product currently does not come in a Token-Ring version.

N/A**—Not applicable: The product does not have this feature because it is strictly a print server.

N/A***—Not applicable: The product does not have this feature because it is strictly a communications server.

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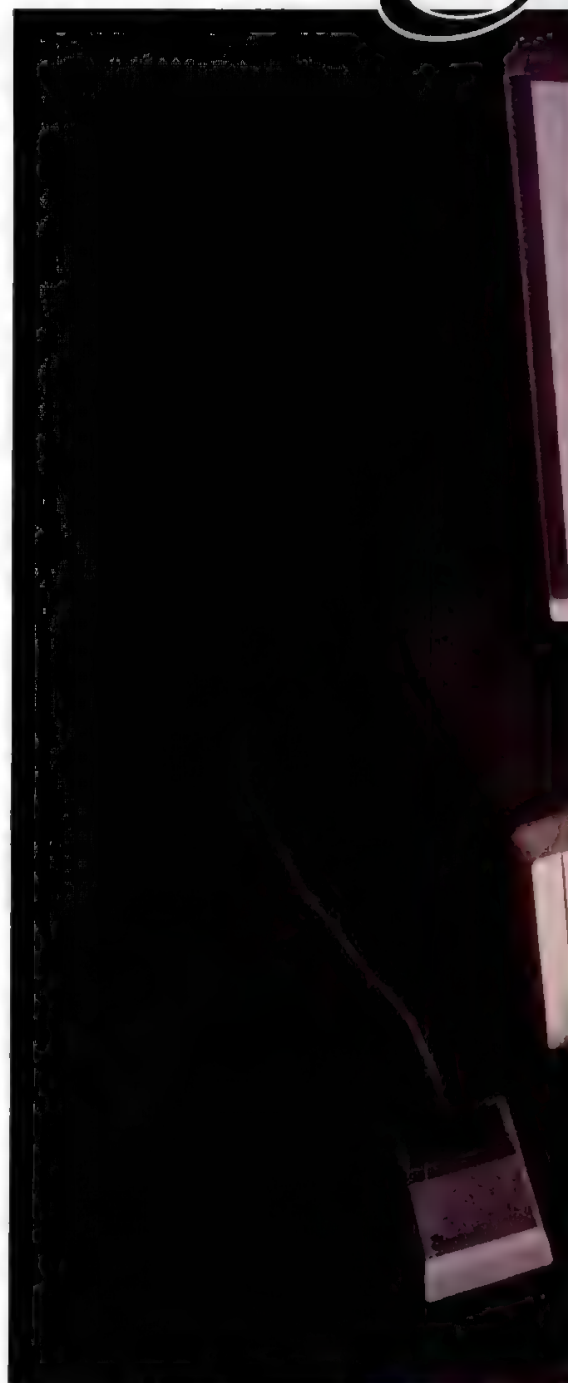
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Video Seven VRAM	2,104 cps

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CIRCLE 107 ON READER SERVICE CARD

MICROTEST INC.
LANport II
by Kimberly Maxwell

If you open up the LANport II box, you'll see a Hitachi 64180 CPU chip with two built-in UARTs, and ROM with special built-in communications and utility software. The device, which measures 1 by 4 by 7.5 inches, looks nothing like a PC, but it can do the communications server job of a PC on a network. The outside of the small box includes two DB-9 serial port connectors, a BNC connector to hook up to the network's thin Ethernet cabling, and a power indicator light.

On the local side, people at networked PCs can share modems that operate at up to 19.2 kilobits per second on a first-come-first-served basis. With two external serial ports, the LANport II can handle two outgoing calls simultaneously. But the device can handle only one incoming call at a time because of the *NetWare* restriction of one client session per Ethernet address.

The LANport II's installation doesn't take as much time as installing a full communications server on a network. You simply copy the files from a single floppy disk included with the package to a directory on the file server, connect a Hayes-compatible modem to the LANport II, and use

When you manage to connect to the LANport II from a remote location, the firmware sends you a menu of actions. You can use the menu to download and upload files, scan directories for a specific

The LANport II's utilities are useful in simple file transactions and activities, but limited in more-complex remote operations. You cannot remotely operate an application using the software included with the package; the LANport II acts only as a gateway for this type of activity. If you want to control a PC on the network remotely through the LANport II, you

This diagram shows the firmware inside Microtest's LANport II, a communications server. Inside the small box resides a Hitachi 64180 CPU chip with

two built-in universal asynchronous receiver/transmitters (UARTs), a programmable array logic (PAL) chip, ROM with special built-in communications and utility software, and an Ethernet controller, transceiver, and Manchester encoder/decoder in the form of a three-chip set manufactured by National Semiconductor. The serial and Ethernet power converters provide electrical isolation between the server and the connecting cables to meet the IEEE 802.3 Ethernet spec. The outside of the box includes two DB-9 serial port connectors and a BNC connector that links the device to thin Ethernet cabling.





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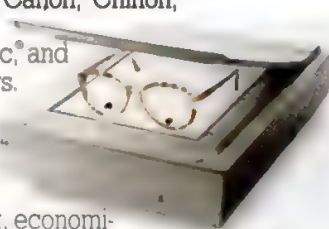
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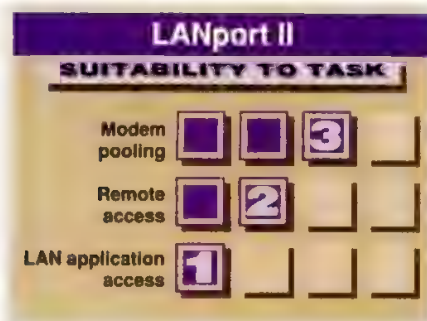


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CONNECTIVITY SPECIAL-FUNCTION SERVERS



must resort to additional remote-control software running on a networked PC. The LANport II works well with remote-control software programs compatible with the DOS interrupt 14 communications routines, like *Carbon Copy*, *Close-Up*, *Co/Session*, *pcAnywhere*, or *Remote²*.

While this solution takes up the resources of a PC, all calling users don't require this capability. If you don't need to control a PC on the network, you can use any other communications software package with Xmodem file-transfer capabilities in the calling computer. Microtest offers its own \$95 package, *Mac LANport II*, for the Apple Macintosh.

SECURITY ISSUES

At PC LAN Labs, security is an important issue. The LANport II provides three types of security to help guard access to the network: password protection, transactional logging, and security callback. These features resemble others found on the marketplace, but with the LANport II you don't need special software. The LANport software reads the *NetWare* bindery—a database holding user

information—and filters callers based on what it finds there.

With the transactional logging feature, you can find out who has logged in and out of the network and see which files users have uploaded and downloaded to and from the network. All transactions are kept in an LPDIAL.LOG system file located in the SYS:SYSTEM directory.

If your network suffers from an abundance of unwanted calls, security callback can help. First, you store the telephone numbers of authorized users in the Novell bindery. Then you use the command-line utility CALLBACK and follow a simple command-line format to add a telephone number to a user list. You can give each number a verbal description and input a phone number of up to 15 digits. Once you enable the callback feature, the LANport II controls the incoming calls by allowing a user to give an ID. It then disconnects the call and dials the number associated with the user ID. You can use security callback in lieu of expensive modems with special security features.

Several other utilities proved useful during our testing. LP2CON allows you to change the settings and disconnect or reset the LANport II. LP2LIST gives a list of modems currently attached and in use with this server. LP2MAP helps set up the virtual circuit between the network and the remote station, and it assists in redirecting the output from the network workstation to the LANport II device. LP2QUERY lets you check the status of a LANport II port or see whether the port is connected to the workstation. Since you may have more than one LANport II on your network, it first gives you the serial number of the LANport II and tells you whether its ports are free.

Microtest offers free technical support at a toll-free number, along with a one-year warranty. The LANport II lets you dial into the network and perform common tasks without forcing you to install a complex access server system. Its strong security, low price tag, ease of use, and small size make it an appealing solution to a potentially complex problem. ■

Frank J. Derfler, Jr., is workgroup systems editor of *PC Magazine*. **Kimberly Maxwell** and **Sara Parker** are frequent contributors to *PC Magazine*. **Randol Tigrett** is workgroup systems project leader at *PC Magazine*.



LANport II

Microtest Inc., 3519 E. Shea Blvd., #134, Phoenix, AZ 85028, (800) 526-9675, (602) 971-6464.

List Price: Ethernet, \$695; Token-Ring, \$1,295.

Requires: Hayes-compatible modem; *NetWare* 286, Version 2.0 or later, or *NetWare* 386, Version 3.0 or later.

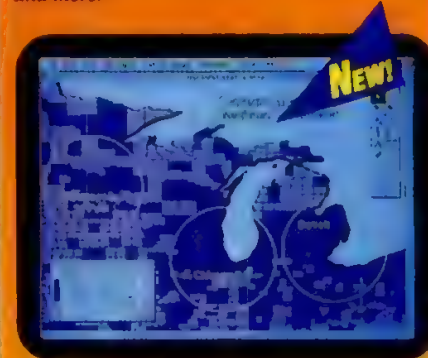
In Short: The LANport II, Microtest's modem server (as opposed to the LANport, which is a print server), is small and easy to install, and it offers a number of security protections. Callers can transfer files, chat with users, and print files on a *NetWare* network without using any additional hardware on the LAN side.

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I'm in control now.

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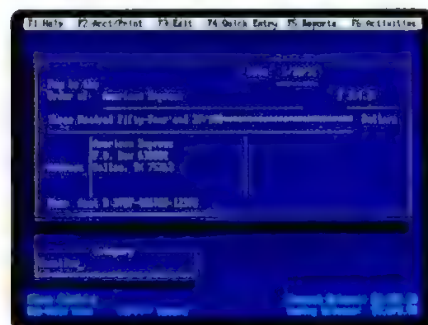
How am I doing? Another keystroke shows my budget-versus-actual. Credit application? In three seconds I've got a financial statement showing income, expenses, and net worth. Tax time? No sweat. Quicken reports all my itemized deductions plus interest, dividends, and capital gains for Schedules B and D.

Organizes investments.

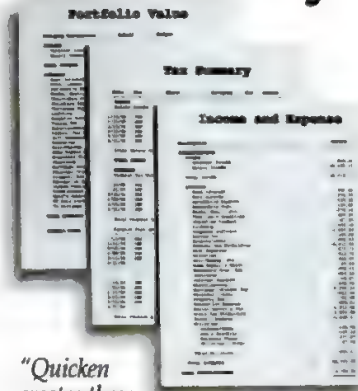
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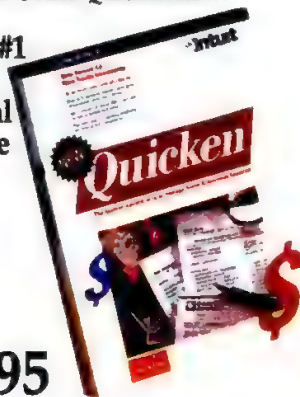
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Lab Notes

As we saw at the end of Part 1, pressing a key on the keyboard deposits a hardware scan code at Port 60h and generates an interrupt 9 signal. The scan codes generated by the original PC keyboard, which were based simply on their physical location, are shown in Figure 1. As a comparison with Figure 2 shows, the introduction of the Enhanced keyboard made the situation somewhat more complicated by requiring additional scan codes for the newly added keys. With either keyboard, however, the BIOS routines invoked by interrupt 9 are responsible for reading the port and turning its codes into the 2-byte sequences (which we have called the ASCII and scan code bytes) that are deposited in the keyboard buffer, a low-memory area that begins at 0040:001E.

To process an ordinary key, for example, the a key, all that the interrupt 9 routines have to do is read the port, place an ASCII a code (61h) and the scan code (in this case the hardware and processed scan codes are the same: 1Eh) in the keyboard buffer area, and adjust the pointer to the tail of the buffer. The handler also needs to check that the buffer isn't full so that it can take appropriate action if it is. (The default is to issue a beep.)

Because the a key must produce different codes in the buffer to reflect the state of the shifting keys and CapsLock, even processing such a simple key becomes a more complex task. Among the steps that the interrupt 9 handler must take, between the striking of the key and the appearance of its 2-byte sequence in the keyboard buffer, are the following:

- If the key hit or released is a shifting key, adjust byte 417h, as explained in Part 1 (and demonstrated there with the BIOS-DATA program).
- If the key hit or released is a lock key, adjust bytes 417h and 418h (see Part 1).
- If any one of four specific key combinations (or the Sys Req key on the AT) is pressed, invoke special processing routines directly. These key combinations are Ctrl-Alt-Del (to initial a reset); Shift-PrtSc

Learning Your Way Around the Keyboard Under DOS, Part 2

■ Here's how keystrokes are turned into the codes in the keyboard buffer and how applications, TSR utilities, and other keyboard programs use them.

(interrupt 5 is called); Ctrl-NumLock or Pause (go into a loop waiting for another key to be hit); or Ctrl-Break (but not Ctrl-C; see below).

- If Alt is pressed, check and specially process the keypad keys (for manually entering ASCII codes, as explained below).
- Determine the ASCII code (the even-address byte to be sent to the keyboard buffer) of the key combination, reflecting the status of Shifts, CapsLock, and NumLock. (Again, as noted in Part 1, on the Enhanced keyboard, E0h instead of 00h is used to distinguish scan codes that exist only on the Enhanced keyboard.)
- Determine the processed scan code (the odd-address byte to be put in the keyboard buffer). If the ASCII code is nonzero and not E0h, this is the hardware scan code, but for certain keys (such as the function keys when a shifting key is also pressed), it may be different.

With all this processing it's easy to see why the interrupt 9 code runs to about five pages in the AT BIOS listing. (The interrupt 16 code for getting keystrokes out of the buffer takes only about one page.) On the original PC, the typematic feature,

which automatically repeats keystrokes if you hold a key down, was also handled by interrupt 9. On the AT and later machines this effect is produced by the keyboard itself. The change added flexibility: On an AT you can adjust typematic speed by sending commands to the keyboard's own on-board microprocessor.

On the XT, adjusting the typematic rates requires using a memory-resident program, which, as we shall see, invites the possibility of conflicts. Such speed-up programs simply "watch" the keyboard to see if you're holding down a key (that is, they've "seen" the keypress code for it, but not the release code) and after a certain time, they start stuffing extra copies of the held-down key into the buffer. The key itself doesn't repeat any more frequently, but the multiple copies put into the buffer make it appear to do so. This procedure can lead to the cursor overshooting its intended stopping point when the added keystrokes get processed after you have released the key. Enhanced typematic programs that will stop the cursor on a dime must operate by using interrupt 16 and can therefore work only in software.

SPECIAL KEY PROCESSING

Even though users think of Ctrl-C and Ctrl-Break as virtually identical keystrokes, they are processed very differently by the BIOS. To the BIOS, Ctrl-C is a key much like Ctrl-B: The pair of bytes 03h and 2Eh are placed into the buffer. On the other hand, when Ctrl-Break is hit, the BIOS calls interrupt 18, where special processing can be done by whoever is controlling that interrupt. When DOS loads, it points

Lab Notes

interrupt 18 toward its own code and runs a routine to set a flag that it sees the next time it checks for Ctrl-C or Ctrl-Break. If, when it makes that check, DOS sees that Ctrl-C or Ctrl-Break has been hit, it calls interrupt 23. Although the end results of Ctrl-C and Ctrl-Break are the same for the default handling set up by DOS and BIOS, by placing different routines on interrupt 18 and 23, an application program can handle these keystrokes rather differently.

Via the Alt-keypad keys, you can manually enter any ASCII code, including those that can't be entered any other way, such as code 235, a Greek lowercase delta. You simply press down the Alt key, type 235 on the keypad, and when you release Alt, the keystroke is entered. What gets placed in the buffer is the ASCII code 235 (EBh), with a 0 in the scan code byte.

Enhanced keyboards must have special smarts to handle something like the separate keypad. Suppose you have NumLock on and press an arrow on the cursor pad. As you can see, by using the INT9 pro-

gram presented in Part 1, the keyboard sends out a complicated set of codes. First, it sends the code that would indicate that you had pressed the Left Shift key, and then it sends the code for pressing the normal Left Arrow key. When you release the arrow, it sends the codes for lifting the arrow and then the code for lifting the shift. Thus it mimics hitting Shift-Arrow, which, when NumLock is on, will send an unshifted arrow! In fact, the situation is even more complicated: To indicate the special enhanced keys, the keyboard also sends E0h scan codes. Thus, when NumLock is on, the four codes E0h, 2Ah, E0h, 4Bh are all sent when you hit the cursor-pad Left Arrow key. As we shall see, under interrupt 16, service 10h, the ASCII code for such a combination is E0h rather than the 00h that the usual Left Arrow sends!

RETRIEVING KEYCODES

How do programs get keystrokes out of the buffer? They could just look in memory, take the keystroke, and adjust the buffer head pointer. But there is a better way. This involves requesting the information from the BIOS, taking advantage of the handling routines associated with interrupt

16. Going through the BIOS lowers the chance that memory-resident (TSR) programs will get in each other's way and also provides a good way for programs like macros to process and translate requests by applications.

When a program issues a software interrupt, the CPU saves the caller's return address on the stack and then jumps to the address stored in the interrupt table (which is stored in the lowest area of memory, as we saw in Part 1) for that interrupt. When the interrupt processing is complete, the IRET (Interrupt RETURN) command pops the return address off the stack and jumps back to it.

Most interrupts serve multiple purposes. The calling program tells the interrupt handler which service it wants by placing the "service number" in the AH register, one of the CPU's general storage areas. Often additional information is passed to the interrupt in other registers, and information is returned by the interrupt handler in those same registers.

Interrupt 16 is used to obtain information about keystrokes, and in the original PC, it offered three services. Service 02h returns the shift status, that is, the contents

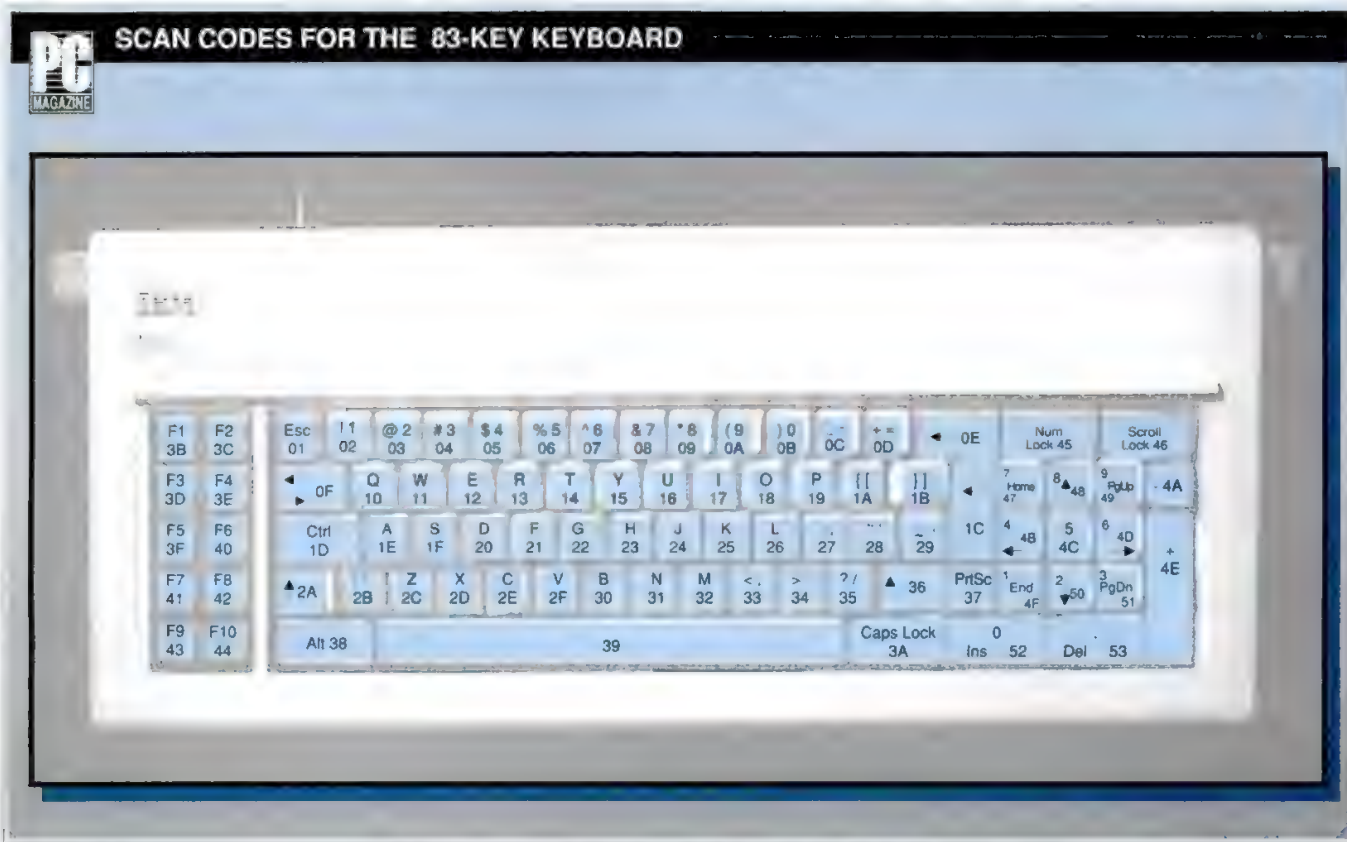


Figure 1: The original PC keyboard-generated hardware scan codes (shown in hex above) based on the spatial location of the keys on the keyboard.

Lab Notes

of byte 417h. This service is rarely used; it's easier for a program just to look at that byte for itself. (Since merely looking at a byte is nonintrusive, there is no reason to worry about conflicts.)

Service 01h asks whether there is a keystroke waiting. The answer is returned in one of the flags that are part of the register set. (Paradoxically, the flag is turned OFF if there is a keystroke waiting.) The keystroke, if present, is reported in the AH/AL registers, with the ASCII part in AL and the processed scan code in AH. Note, however, that when service 01h returns to the caller, it leaves any waiting keystroke in the buffer.

Service 00h is the main service for interrupt 16. It returns a keystroke in the AH/AL registers and removes the keystroke from the buffer. It doesn't actually delete the keystroke from memory but simply changes the address of the head of the buffer. With service 00h, if there is no keystroke waiting, control is not returned to the original program. Instead, the inter-

rupt handler loops back, continually looking for a keystroke, and it returns only when a keystroke is ready.

Programs generally use one of two strategies to get keystrokes. Some just call service 00h and wait for the keystroke. Such programs will often spend most of their time looping in the interrupt handler. Multitasking systems like *DESQview* typically have special ways of handling such requests from applications so that background programs waiting for keyboard input do not get CPU time.

The other strategy is to use service 01h periodically, to check whether there is a keystroke waiting and to use service 00h only when service 01h sends back a positive report. Between requests to service 01h, the program can do housekeeping, such as updating an on-screen clock.

In the original PC, XT, and the first release of the AT, services 00h and 01h returned whatever bytes were in the buffer whether they were "legal" keystrokes or not. On a vanilla system, only legal keystrokes were in the buffer. Keyboard macro programs and programs like *DESQview*, however, would use illegal combinations, which they typically pro-

cessed (usually by additions to the interrupt 16 routine) before the illegal codes could reach the underlying program.

With the advent of the Enhanced keyboard, initially on an AT but later on PS/2s, five new interrupt 16 services were provided. The most significant were services 10h and 11h, which are used to recognize new keys like F11 and F12.

Because the BIOS designers worried that a non-Enhanced keyboard program would become confused if it called service 00h and got the codes for F11—which it obviously couldn't know—Services 00h and 01h were rewritten to filter out keystrokes corresponding to combinations illegal under the old BIOS. Services 10h and 11h then allowed a program to read keys like F11. Service 10h is the analog of the old, unfiltered 00h, and 11h is the analog of 01h. The filtering broke a lot of TSRs, which had to rush to put out new versions in order to cope with the change in services 00h and 01h.

Service 12h, an analog of 02h, returns the bytes at both 417h and 418h. As we'll see, this service is often used for other than its nominal purpose of reading the shift status! Service 03h sets the typematic rate on



Figure 2: The enhanced PC keyboard makes use of a second scan-code byte (E0) to distinguish duplicate keys.

Lab Notes

an AT keyboard, and 05 is used to stuff keystrokes into the buffer. Most programs that directly manipulated the keyboard buffer continued to do so, since they wanted to use the same routine for both pre- and post-Enhanced BIOS.

To illustrate how interrupt 16 works

with both types of BIOS, I've written a simple program called INT16.EXE, which you can download from PC MagNet. (Note: Instructions for downloading programs, including all those referenced in this Lab Notes, are printed in the article on this issue's free utility, PCSPOOL.EXE. Commented Turbo Pascal source code is provided with the download.) Entered without its optional E parameter, INT16 calls interrupt 16, service 0 and returns the

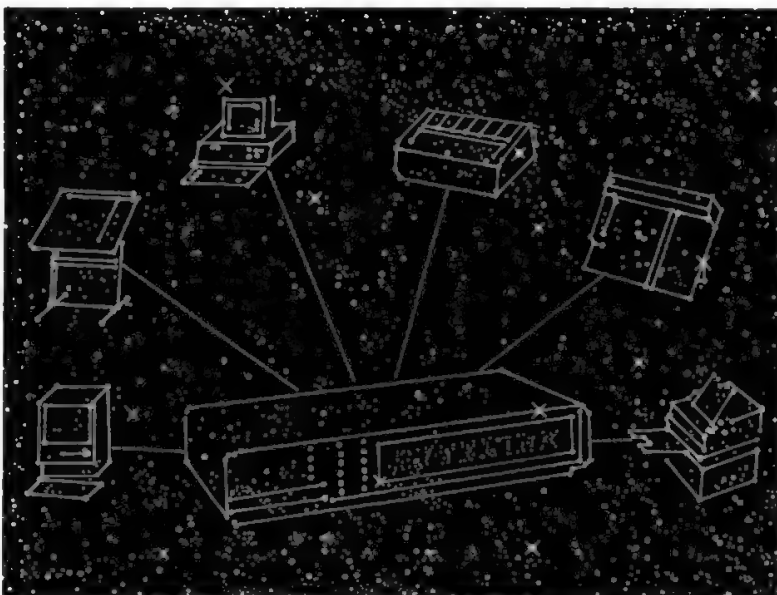
scan code and ASCII part in hex and decimal. It exits when you hit Esc. By entering INT16 E the program will instead call service 10h, though only if you have an Enhanced BIOS. (If you didn't have an Enhanced BIOS and service 10h were called, the program would never see an Esc, and you wouldn't be able to exit.) The program will inform you as to whether it's reading the normal or the Enhanced keyboard. If you have an Enhanced keyboard, you might try running this program both ways and see how F11 and Ctrl-Up Arrow are treated in each case.

The introduction of the Enhanced keyboard forced programs to make an important choice when asking for keystrokes. If they wanted to use F11, F12, the second keypad, and "new" keystrokes (such as Ctrl-Up, which the old BIOS did not support), the programs would have to call service 10h. If they did this on a machine with an old-style keyboard, they'd get nonsense and potentially could even hang.

Programs thus need a way to check for the presence of the Enhanced BIOS. A method sometimes used is to check the byte at 0040:0096. This is normally 00h on old-fashioned BIOS and not 00h on Enhanced BIOS. Unfortunately, for some clones this method is not foolproof. Another method (used in the demonstration program INT16.EXE) is to put a known quantity, such as 40h, into byte 417h (the shift-state byte) and then call service 12h of interrupt 16. On an Enhanced keyboard, this service will read the byte at 417h and should return a matching 40h in AL. Just to be sure, you now change the shift state to a different known quantity and check again for a match in AL. Only if the Enhanced BIOS is present will you get matches in both trials.

As mentioned above, the introduction of the Enhanced keyboard BIOS broke a fair number of existing programs. A typical problem report was that Micro Logic's *Tornado Notes* would no longer pop up over *WordPerfect*. Here is what was happening: *Tornado* was using an interrupt 16 pop-up strategy (we'll discuss the various pop-up strategies immediately below). This captured and chained interrupt 16 and checked services 00h and 01h to see whether its hotkey was the next keystroke in the buffer. If it was, *Tornado* would pop up. But if *WordPerfect* found an Enhanced BIOS, then it would call services 10h and 11h. But *Tornado* had been programmed to look only at services 00h and 01h—which were never called! Micro

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Logic has fixed the problem with the recent release of *Info Select*, a personal information manager.

TSRs AND KEYBOARD MACROS

One big advantage of using interrupts is that programs—memory-resident (TSR) pop-ups, keyboard enhancers, and the like—can interpose their own operations between the call to the interrupt and the execution of its handling routines. A program can do this simply by putting its own address at the point where the interrupt handler's address would ordinarily be found. The intervening program itself would then normally call the routine that was previously at that interrupt address, thus splicing its own operations into the instruction series. If several programs did this in succession, you would wind up with a chain of programs, each calling the next one. Not unnaturally, this procedure is called "chaining the interrupt."

The ever-popular TSR utilities all work by "grabbing an interrupt" and checking for a hotkey or shift state. This is one of the beauties of the interrupt structure. A program can leave its code resident and turn over the system to DOS, which allows programs to run. But the TSR, triggered by an external event or a service request from the underlying application, can periodically get control. Normally, all it does is see that it isn't wanted and passes control back. But when it sees its specific hotkey combination, it pops up and keeps control until you command it to pop down.

There are three common strategies for initiating the pop-up: interrupt 16, timer/shift, and interrupt 9. The interrupt 16 approach is rarely used; it depends on an underlying program requesting a keystroke. The way it works, however, is as follows: While the TSR is loading, it stores the old interrupt 16 address in its code segment and places an address of its own routine in the low-memory address called by interrupt 16. That is, it puts the address of its routine in the Interrupt Vector Table, at interrupt 16's "slot." Another TSR may load later and take interrupt 16, but as long as the new TSR properly chains interrupt 16, the first TSR will normally get control during each interrupt 16.

When the underlying program requests a keystroke with interrupt 16, the TSR gets the call. The TSR then calls the original in-

terrupt 16 in such a way that it regains control before the underlying application does. It then checks the keystroke that interrupt 16 is returning. If the stroke is not its hotkey, the TSR passes control back to the underlying application. If it is the hotkey, the TSR pops up and interacts with the user.

Some TSRs will place their address in the interrupt table by directly manipulating memory. Interestingly enough, changing an interrupt vector is so basic to the PC's operation that programs can ask DOS to do it for them—and most TSRs do.

The second strategy involves chaining interrupt 8, the *timer interrupt*, which is triggered 18.2 times per second by the interrupt controller. During each interrupt 8, the TSR gets control briefly and looks at byte 417h to see if its shift hotkeys are

**TSR utilities all work by
"grabbing an interrupt"
and checking for a
hotkey or shift state.**

pressed. If they aren't, the TSR passes control on. At first blush, it might seem to impose a terrible performance drag to have one or several TSRs getting control 18.2 times per second. But even on the slowest PC, there are over 50,000 CPU cycles between calls to interrupt 8 (there are almost ten times that on the fastest 33-MHz machines). A well-written assembly language routine will use only about 50 of these cycles to check that it isn't wanted, and even a compiled language won't use more than a few hundred.

The third strategy is similar to that for interrupt 16, but it involves looking at interrupt 9. This means that the TSR can react immediately to the user's hitting a key instead of waiting for an underlying application to request a keystroke. In fact, so much work is done with interrupt 9 by a system like *DESQview* that modern TSRs do not pop up on interrupt 9. Rather, they set a flag (change a byte in their data area) and check for that flag using a separate interrupt 8 routine. The disadvantage of an interrupt 9 routine is that it can't be emulated by a keyboard macro program or a keyboard stuffer like *Keyfake*. But this is far

outweighed by the fact that the interrupt 9 interrupt 8 routine works, and the others basically don't.

When a keyboard macro program is loaded, it chains into interrupt 16 so that when a program calls an interrupt 16, control is passed first to the macro program. The macro program, in turn, begins by calling the original interrupt 16 (whose address it has stored) in a way that control returns to the macro. The macro program can then check whether the keystroke in the buffer is one that it is supposed to translate. If it is, then it will return the translated keystroke to the underlying program. (Obviously the macro code will need to be complex in order to handle multikey translations, nested macros, and so on.)

Next, let's see how various keyboard enhancers work. How about a buffer expander to give you more than the 15 keystrokes of type-ahead? If you load the BIOSDATA demonstration (from Part 1) and look at the 4 bytes starting at address 480h, you should see

1E 00 3E 00

You'll recall that the keyboard buffer starts at 0040:001E, and the byte immediately after the buffer is 0400:003E. Words (16-bit quantities) are stored in memory with the lower half first, so 001E is stored as 1E first and then 00h. Hence, addresses 480h and 482h actually give the start and end of the buffer relative to 0040:0000.

In principle, a program could expand the buffer simply by changing those addresses. In fact, because not all machines support this scheme (some early Tandys didn't!), not all programs think to look there. Moreover, it isn't always possible to place an enlarged buffer in the 64K above 0400:0000 (which is where addresses 0400:xxxx lie), so no commercial program uses this expansion technique.

Still, simply as an experiment, I've written MOVEBUF.EXE, which is just like BIOSDATA but which starts by moving the pointers to B0 and F0. This gives you a 31-keystroke buffer. MOVEBUF also adjusts the bytes at 0040:001A and 0040:001C, which point to the head and tail of the buffer, so that they point instead to the new buffer region. Load MOVEBUF and try hitting keys. When you exit, it restores the buffer pointers. While I know of no BIOS that stores data in that area, there may be some, and in any event you should exercise care, since some BIOS may not act properly for other rea-

Lab Notes

sons. But you'll probably find that this experimental double-size buffer works.

An alternative approach might involve rewriting interrupts 9 and 16 and moving the buffer elsewhere. Still, there very well may be conflicts. The buffer extender that comes with *SmartKey* does just this, and

there are conflicts! Instead, a more satisfactory extender would modify the interrupt 9 Interrupt Service Routine (ISR). Unfortunately, explaining such a bullet-proof extender would take us beyond the scope of this Lab Notes.

MISSED OPPORTUNITIES

Only a few related keyboard issues remain to be discussed. First, you should know that there are some programs that use a

DOS service to get keystrokes rather than calling interrupt 16. Never do this with your own programs, for the DOS service is brain dead! It calls interrupt 16 itself, but it normally throws away the processed scan code and returns only the ASCII code. If it always did this, it would throw away all keys whose ASCII code is 0! So in such cases the DOS service stores the scan code, and if you immediately follow the DOS call by a second one, it will return the scan code. This is more awkward than the interrupt 16 code, which almost all modern programs use. But to illustrate how far rampant nonsense can spread, although Turbo Pascal uses interrupt 16 rather than DOS, it mimics the DOS convention of requiring two calls to get function keys. I can only urge Turbo programmers to replace the standard readkey with one that uses interrupt 16 directly.

When the Enhanced BIOS and keyboard were introduced, extra code that calls interrupt 15, service 4Fh (with AL containing the scan code) was added to interrupt 9. Thus, a program can put itself in the interrupt 15 chain, get the keystroke, and prevent it from being processed further—all without needing to access the hardware or play other games. Many problems could be avoided if all TSRs used this method, but since not all machines support it, this useful code remains an untapped resource. Compatibility dictates that programs must continue to access interrupt 9 directly. Too bad!

Perhaps the biggest lost opportunity was in the original BIOS design. The 2 bytes stored in the buffer for each keystroke can describe 64K different combinations, and most of those just aren't used. For example, if the ASCII part is 2Bh (Plus), then only three of the 256 possible values for the other byte can occur: 0Dh (top row Plus key), 4Eh (gray Plus key), and 00h (entered via Alt-keypad as ASCII decimal 43). Imagine how much more useful it would be if the scan code and state of the shifts were stored with interrupt 16 doing the translation. There could then be an additional interrupt 16 service to give the raw data to a program that needed it.

But dreams of what might have been must give way to the realities that are, and I hope that this tour has given you a good idea of how your keyboard works and how programs, from normal applications to TSRs, interface with it. ■

Barry Simon is a contributing editor of PC Magazine.



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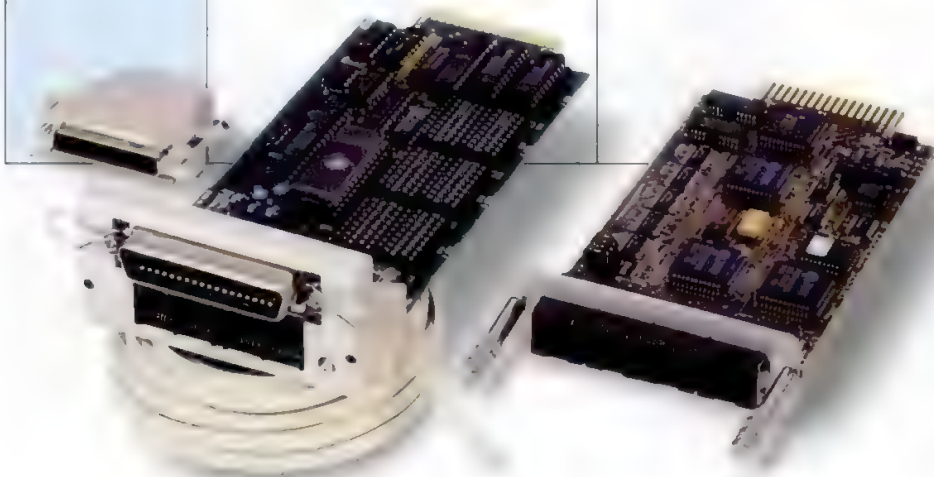
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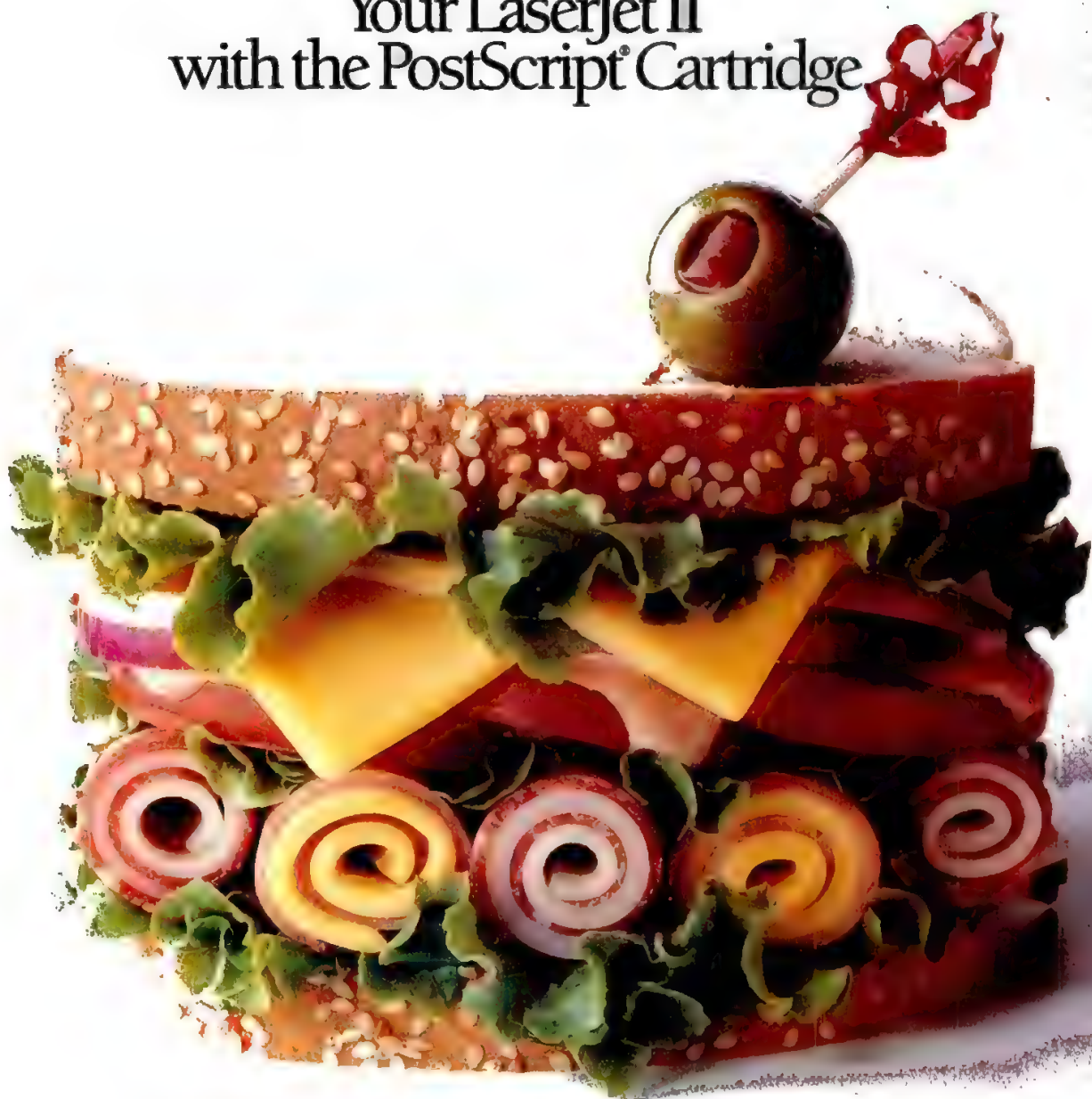
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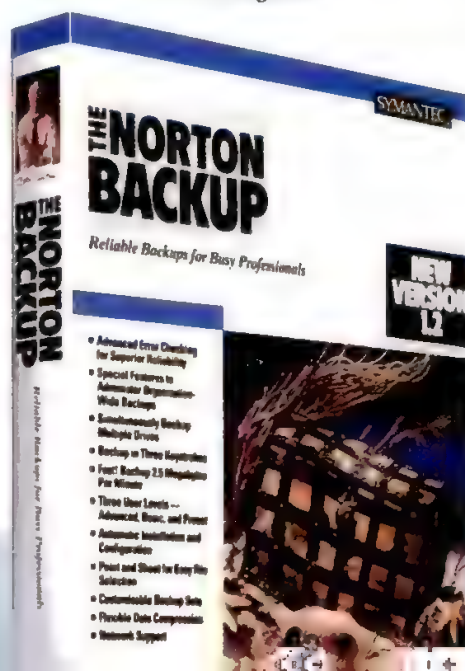
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CIRCLE 302 ON READER SERVICE CARD

by
Michael Holmes
and Bob Flanders

Utilities

Why should you have to sit idly by waiting for a long printout to finish before you and your PC can get back to useful work? You shouldn't—and you don't. Spooling programs have long been used to break the real-time bond between fast computers and slow printers, and this issue's utility, PCSPOOL.COM, will put spooling to work for you.

With PCSPOOL, your application does its "printing" into a queue file, which is stored either on-disk or in memory. That done, you and your PC are free to go on to other tasks, while your printer, operating in the background, takes its own sweet time transferring the file onto the paper. PCSPOOL incorporates many of the most desirable features usually found on both individual and network-style spoolers: up to three printers can be controlled simultaneously; individual files within the queue can be separated by form-feeds and pauses to change paper; queued files can be skipped or canceled; printer status can be observed and printer mode can be reset; and even the time it will take to print the material in the queue can be displayed.

Instructions for downloading a ready-to-run copy of PCSPOOL.COM from PC MagNet are given in the sidebar "PCSPOOL by Modem." If your communications setup can't handle binary files, you can instead download PCSPOOL.BAS from PC MagNet and run it once in BASIC to create the PCSPOOL.COM file. As a third alternative, if you want to modify or assemble the program for yourself, you should download PCSPOOL.ASM. (In this case you'll also need an IBM or Microsoft macro assembler, Version 2 or later.) Instructions for changing the default hotkey are presented in the sidebar "Changing PCSPOOL's Hotkey."

USING PCSPOOL

PCSPOOL is a memory-resident (TSR) utility. Four of its basic functions are controlled from the command line; others are actuated from a pop-up window that uses

PCSPOOL Lets You Get Back to Work While You Print

■ If you have to wait for long printouts to finish, this feature-packed spooler utility will free up your PC for more-productive uses.

Ctrl-Alt-P as its default hotkey. When installed, PCSPOOL occupies approximately 7K of RAM.

The command syntax to install PCSPOOL from the DOS prompt is

```
PCSPOOL /I [/1] [/2] [/3]  
[/Cnn]/D[d:\path]
```

To cause the printer to pause, enter

```
PCSPOOL /P [/1] [/2] [/3]
```

To send a form-feed to a printer, the command is

```
PCSPOOL /F [/1]/[2]/[3]
```

And to uninstall the program, use

```
PCSPOOL /U
```

Note that PCSPOOL's /I (install), /P (pause), /F (form-feed), and /U (uninstall) commands cannot be combined but must be executed separately from the DOS prompt.

The /I switch installs PCSPOOL, initializes the printer(s) you want the program to control, and determines whether to put

the print-queue file in memory or on-disk. For example, if you have printers connected to LPT1 and LPT2 and you'd like to control both with PCSPOOL, you would enter

```
PCSPOOL /I /1 /2
```

You need not tell PCSPOOL which printers to control initially. You can install the program with no printers selected and use the pop-up window to choose a printer later. Or, for example, if you have printers connected both to LPT1 and LPT2 and you want to start PCSPOOL with control of LPT1 only, you would enter

```
PCSPOOL /I /1
```

Later, if you want to give PCSPOOL control of LPT2, you can press the Ctrl-Alt-P hotkey combination, which will display a pop-up window similar to the one shown in Figure 1. You can then enter Ctrl-G (Go for LPT2), as explained more fully below in the section describing PCSPOOL's pop-up window.

One limitation of PCSPOOL is that it cannot control printers attached via serial ports, even if they have been set up using the DOS MODE LPTx:=COMx: command. The optional parameters /1, /2, and /3 in the command syntax stand respectively for LPT1, LPT2, and LPT3 only. The routine that PCSPOOL uses to send data to the printer expects to control a parallel printer port; the program has no routines to handle sending data to a COM port. When a printer is not controlled by PCSPOOL, data is sent to that printer as usual and is

Utilities

not placed in the spooling queue before it is sent to the printer.

Using the `/Cnn` switch during installation tells PCSPPOOL to set aside *nn*K of conventional (DOS) memory to hold the queue. Values for *nn* can range from 1 to 64; if no value is specified, a 16K queue is reserved. Thus, to start PCSPPOOL with control of LPT1 and a 24K queue, you would enter

```
PCSPPOOL /I /1 /24
```

The alternative `/D[d:\path]` switch lets you put the printer queue on-disk. Note that there may be no spaces between the `/D` and the first character of the optional drive and path. Although PCSPPOOL does not otherwise support EMS, the drive letter of an EMS RAM disk can be used for *d*: with the `/D` command. If you do not specify a drive or path, the file will be placed in

the root directory of the C: drive.

Regardless of the number of printers controlled by PCSPPOOL, only one queue file, named PCSPPOOL.QUE, is created. Its size is limited only by the amount of free space on that drive. For example, to tell PCSPPOOL to control LPT1 and LPT2 and place the queue file on drive E: in the `\TMP\WORK` directory, you would enter

```
PCSPPOOL /I /1 /2 /DE:\TMP\WORK
```

If you specify a bad drive or path, PCSPPOOL will not be able to initialize the queue. In this case, an error message is displayed and the spooler will not be installed. Note that if neither the `/C` nor `/D` switch is specified, the default is a 16K conventional memory queue.

ADDITIONAL COMMAND-LINE OPTIONS

The `/P` switch sends a pause command to the printer designated by `/1`, `/2`, or `/3`. If no number is specified, LPT1 is assumed.

The pause command may be issued at any time as a command from the DOS

prompt, as a line of a batch file, or as the result of a program asking DOS to execute PCSPPOOL with the `/P` parameter. When the pause command is issued, a record is written to the printer queue. This record is placed immediately following the last byte of data that has been sent to the queue at that point. The pause record contains not only the pause request, but also any comment placed after the printer number.

When PCSPPOOL encounters a pause record in the queue, the associated printer is halted and the comment is saved for display when the pop-up window is called up by the user. When the pop-up window is requested, the comment is shown on the line for that printer. For example, consider the following commands:

```
PCSPPOOL /I /1 /24
COPY FILE1.TXT LPT1
COPY FILE2.TXT LPT1
PCSPPOOL /P /1 FILE3.TXT about to
print
COPY FILE3.TXT LPT1
```

When this command sequence is executed, the first line starts PCSPPOOL and tells it to control LPT1. The printer will begin to print as soon as the copying of FILE1.TXT begins, and after FILE2.TXT has been printed, PCSPPOOL will stop the printer. At this point, if the pop-up window is activated with `Ctrl-Alt-P`, the message "Paused: FILE3.TXT about to print" will be displayed on the LPT1 line. LPT1 will not print the data from FILE3.TXT until it gets a (G)o command from the window. For this reason the pause command is very useful for placing action requests between printouts. For instance, before running a set of checks, you might issue the following command:

```
PCSPPOOL /P /1 Please put checks in
printer
```

The PCSPPOOL `/P` command parameter should not be confused with the (P)ause command issued via the pop-up window. While both are pause commands, they have somewhat different effects, as will be explained below in the section on the pop-up window.

The `/F` switch causes a form-feed to be sent to the printer designated by `/1`, `/2`, or `/3`. If no printer is specified, the form-feed is sent to LPT1. The `/F` command lets you insert a page break into the print stream either via a batch file or from the DOS prompt. Thus, for example, to send a

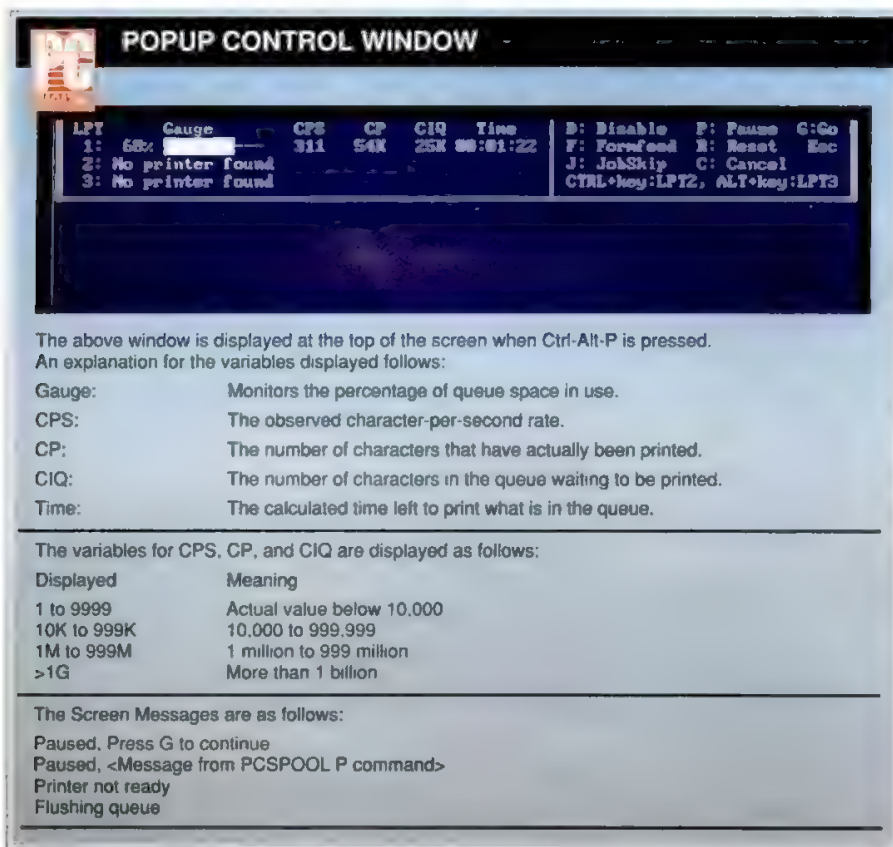


Figure 1: Pressing `Ctrl-Alt-P` brings up PCSPPOOL's window, which displays printer status and queue usage, printing speed, number of characters printed, the number of characters remaining in the queue, and the time needed to print them. Pop-up window commands, shown above, are executed from the window by pressing the indicated keys.

Utilities

form-feed to LPT2, you would enter

`PCSPPOOL /F /2`

Note that PCSPPOOL does not have to be installed to execute this command.

The /U switch uninstalls PCSPPOOL, if possible. To remove the program from memory, you simply enter

`PCSPPOOL /U`

The /U command will fail if another TSR using one or more of the same interrupts used by the spooler is run after PCSPPOOL. Any such programs must be removed before PCSPPOOL. This can usually be done by uninstalling the other TSRs in the reverse order of their installation or by using the utilities MARK and RELEASE.

If you attempt to uninstall PCSPPOOL while data is still queued for printing, you will get the message: "Waiting for print to complete. ESC cancels shutdown. Hit any

other key to uninstall immediately." If no key is pressed, PCSPPOOL will uninstall when the queue has been emptied.

THE CONTROL WINDOW

After installing PCSPPOOL, you can display its status and perform control functions by pressing the Ctrl-Alt-P hotkey. This brings up a window at the top of the screen, as shown in Figure 1.

The lines that display the status of the three possible printers are self-explanatory. Under the heading Gauge is a numeric percentage and a line that indicates the percentage of the queue space being used by that printer. The next field, CPS, shows the printing speed, in characters per second. As PCSPPOOL is printing, it captures the number of characters printed and the amount of time it takes to print those characters. The CPS is calculated by dividing the number of characters printed by the amount of time it took to print them.

The next two numbers, under the headings CP and CIQ, indicate the number of characters printed (CP) and the number of characters that remain in the queue (CIQ). Exact values are shown up to 9,999; from

10,000 through 999,999 the numbers are displayed as 10K through 999K. Millions are shown as 1M through 999M and 1 billion or higher is displayed as >1G (giga-byte).

Finally, the value shown under the Time heading is the amount of time needed to print the characters in the queue, based upon the calculated CPS. Note that this value reflects only the time required to print the data currently in the queue. That is not necessarily the amount of time that will be required to print the entire file, for the latter may not all be in the queue at the time you invoke the pop-up window.

If statistics about a printer are not shown in the window, one of the following messages will appear, with the meanings indicated:

- Printer not ready: This printer is off-line or powered down.
- Paused, Use GO to continue, or Paused: *comment*: The indicated printer was given a pause command. Type G to continue printing.
- Flushing Queue: Data is being removed from the requested printer's queue as the result of a JobSkip or Cancel command is-

CHANGING PCSPPOOL'S HOTKEY

by Bob Flanders

You can change the hotkey that pops up PCSPPOOL's window from its default of Ctrl-Alt-P to another keystroke combination by using DEBUG.COM. Before doing so, however, be sure to

make a backup copy of PCSPPOOL.COM so you won't lose the program should something go wrong.

In order to customize the hotkey, you must change 2 bytes in the .COM file: the shift mask and the scan code. These are located at xxxx:025C and xxxx:025D in the file. (The 8 previous bytes provide the label "Hot Key>", for those who wish to use DEBUG's d, or display, command.) The shift mask byte controls the combination of "shifting keys" (Ctrl-, Alt-, Left Shift, Right Shift) that are pressed together with the letter key. A table of the possible values is shown in Figure S1. The scan code byte controls which letter is pressed together with the shifting keys. A complete table of scan codes is shown in Figure 1 in the Lab Notes column published in this issue.

In order to make changes to these bytes, you need to enter

`debug pcspool.com`

At the hyphen prompt, enter

e 25c

The screen will display 0C, with the cursor located immediately after the period. The 0C is the default shift mask value that corresponds to Ctrl-Alt, as you can see from Figure S1. To change this to Alt-Left Shift you would simply type in 0A and press Enter.

Again at the hyphen prompt, if you now enter

e 25d

the screen will show 19., which is the scan code for the letter P. To change this to X, you would type in 2D and hit Enter.

To write these changes to disk and quit DEBUG, you would then enter the following lines:

w

q

PCSPPOOL will now use Alt-Left Shift-X as its hotkey. ■

SHIFT_MASK Value	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	Pressed
Alt																	
Ctrl																	
L-Shift																	
R-Shift																	

Figure S1: The combination of Shift keys needed to pop up the program corresponds to a unique SHIFT-MASK value in the PCSPPOOL.ASM listing. Substitute any of the values above for the default Alt key.

Utilities

sued by the user in the pop-up window. (These commands are explained below.)

■ **Not currently spooled:** The printer is not currently controlled by PCSPOOL. Either this printer was not included in the PCSPOOL /I command or it was disabled via the (D)isable command in the pop-up window.

■ **No printer found:** There was no printer port found by the BIOS for this position. This printer is disabled for this session and cannot be spooled.

While the pop-up window is displayed, several control functions are also available: Disable, Pause, Go, Form-feed, Reset, Jobskip, and Cancel. You can execute these functions for LPT1 simply by pressing the first letter of the function name. To execute the function on LPT2, you press the Ctrl key and the indicated letter. Similarly, to apply the function to LPT3, press Alt-letter.

The (D)isable command causes the requested printer to revert from spooled mode to unspooled mode. Any data sent to this printer from a program will be printed immediately, without buffering. Any data in the spool that had been destined for that printer is retained and will be printed when the printer is spooled again.

Like entering PCSPOOL /P at the DOS prompt, issuing the (P)ause command from the pop-up window causes the printer to suspend its operation. With either of these commands, printing is resumed by means of the (G)o command from the pop-up window. The pop-up window (P)ause command does not, however, insert a pause request record in the queue, as does the PCSPOOL /P command. From the moment the pop-up (P)ause is issued, no more data is sent to the printer (although data can continue to be deposited in the spool or queue) until the (G)o command has been issued for that printer.

Note that if the printer has been halted with a pop-up (P)ause command and the PCSPOOL /P command is then issued, it will take *two* successive (G)o commands to restart printing. The first allows PCSPOOL to resume reading from the queue, where it then encounters the /P command from the queue and pauses the printer again, this time displaying any included message. The second (G)o is then needed to allow PCSPOOL to continue reading the queue. If this command se-

quence is reversed, so that the pop-up (P)ause command is issued when a /P command is active, the pop-up (P)ause command is simply ignored.

If a printer is either disabled (not controlled by PCSPOOL) or in its pause mode, the (G)o command tells PCSPOOL to take control of the printer or to continue printing from where it left off. If the requested printer displays the "No printer found" message in the window, however, it cannot be controlled by PCSPOOL.

When you want to be sure the next part of a printout starts at the top of a new form or page, you can issue the (F)orm-feed command for the active printer. Note, however, that if you execute this command while a program is copying data to the queue, the form-feed will end up at an

Spooling is a process in which data being sent to a printer is captured and placed on-disk or in memory.

arbitrary place in the middle of the printout. In general, the pop-up (F)orm-feed command should not be used while data is still being sent to the queue by a program.

There are occasions on which printers need to be reset after printing a set of data. The pop-up (R)eset command inserts a BIOS Printer Reset into the print queue of the requested printer. This will usually cause the printer to revert to its power-up mode. Note, however, that if the printer to be reset has a data buffer, the reset may cause the data in that buffer to be lost. Nor is there any guarantee that the reset command will work with all printers. As with the (F)orm-feed command, if issued while data is being sent to the print queue or from the print queue to the printer, the reset will occur at an unpredictable point in the middle of the printout.

Occasionally, after a file is sent to the queue, you find that you don't want it or wish to discard a portion of it. The (C)ancel command flushes all information currently destined for the requested printer. Once it has been flushed, the data cannot be retrieved.

Finally, if you use the PCSPOOL /P command between segments of printout, you can skip to the next segment of the queued data by using the (J)obskip command. When issued, the data for requested printer is flushed up to the next pause record in the queue. If no subsequent pause record is found, this command will have the same effect as the (C)ancel command.

HOW SPOOLING WORKS

Spooling is a process in which data being sent to a printer is captured and placed on-disk or in memory. Whether the spooler is memory or disk based, however, a certain amount of conventional memory is required. Spoolers written to execute from and use EMS memory may need less than 1K; other spoolers may require dozens of kilobytes between buffers and program. In either case, however, so far as the program that generates the document is concerned, the data is "out the door" and printed as soon as it has been deposited in the queue. That frees the program to go on to other tasks at full speed. The printer itself then gets the data at its own pace from the temporary storage area that constitutes the queue. Naturally, there is some increase in CPU utilization when spooling is active, but the slowdown is usually minimal and generally will go unnoticed on all but the slowest CPUs.

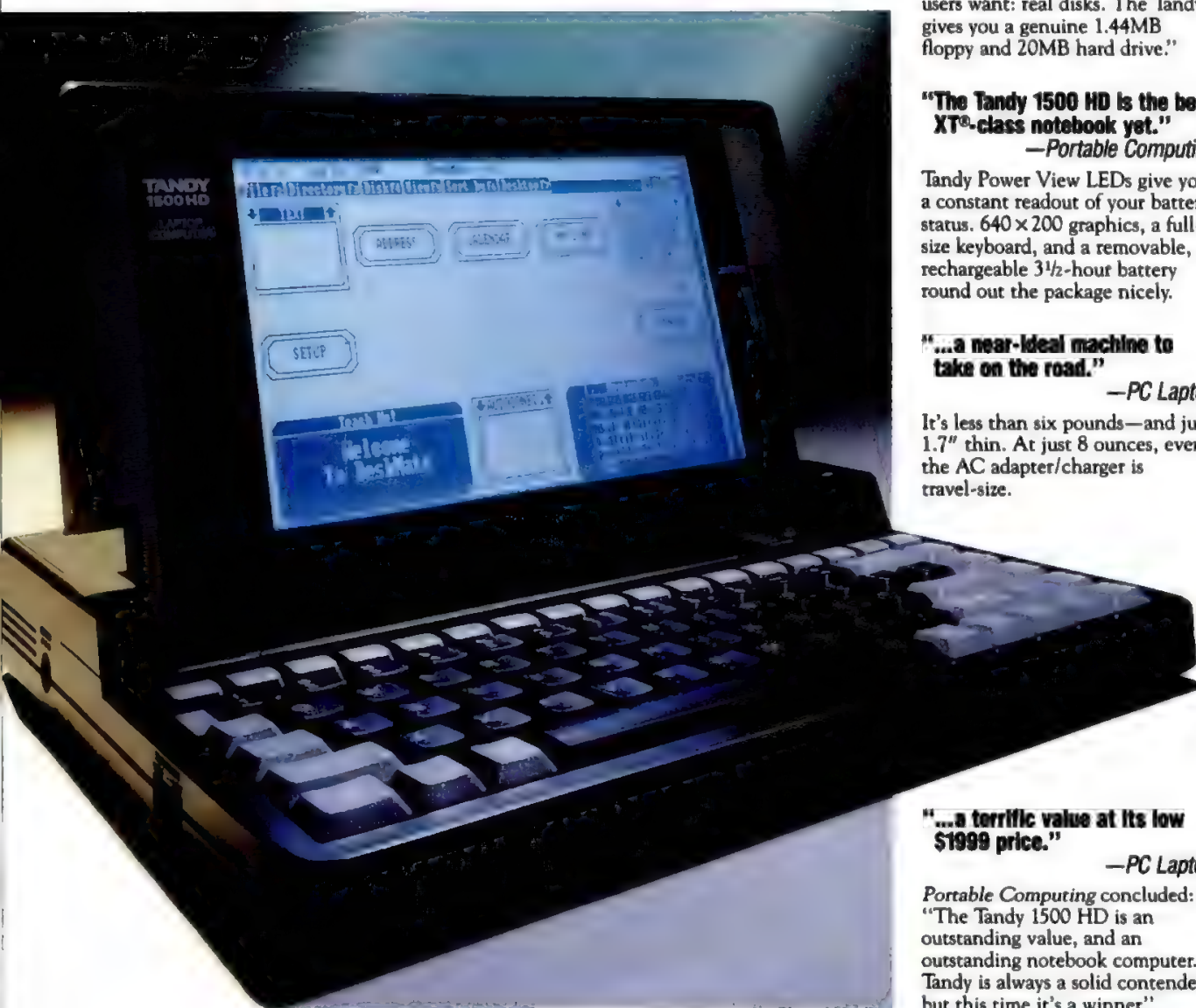
Individual PCs most commonly use a *memory buffer* spooler, in which programs print data into a buffer from which the data is then sent to the printer. In its basic form, this type of spooler usually intercepts interrupt 17 (the BIOS printer interrupt), and interrupt 08 (the timer interrupt). When an application attempts to send data to the printer, the spooler simply intercepts the data and places it in the next available byte of the memory buffer.

When it processes the timer interrupt (about 18 times a second), the spooler checks the buffer to see whether there is any data to print and whether the printer is ready to accept it. If so, data is removed from the buffer and sent on to be printed. Such spoolers often provide a number of printer control options (go to top of form, reset printer, reprint previous page, and so on), visible status checks (printer status, bytes in queue, bytes printed, and so on), and queue control (cancel queue, uninstall, and so on).

Network spooling programs have two *raisons d'être*: they allow users to share expensive printers, and they prevent data sent from different individual nodes from

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CIRCLE 495 ON READER SERVICE CARD

Utilities

becoming intermixed on the printer. Almost all networks use *disk-based* spoolers. The data to be printed is intercepted at user nodes and is sent to the server, where it is placed on-disk until it is ready to print.

Three methods are commonly used to tell the network when to print the data: the user issues an explicit command telling the network to print the data; the network no-

tices that the user has returned to the DOS prompt or closed the print file; or a predetermined amount of time elapses before the node's output data is printed.

To prevent the intermixing of data from the various user nodes, the network spooling system must maintain separate buffers for each user on the network. This convinces each user node that it has a separate printer.

Most networks open a "print job" when a user node starts spooling to the network. When a set of data has completed

spooling and the user informs the network that the "printing" is complete, the network can then send the print job to the appropriate printer when one becomes available. The network can usually modify its print jobs in various ways, such as changing their priority, placing them on hold to print at a later time, canceling individual jobs outright, or changing their ultimate destination.

It should be noted that the ability to redirect a print job to another printer can sometimes produce unexpected side ef-

INTERRUPT 17 CALLS ADDED BY PCSPOOL

by Bob Flanders

PCSPool implements all of the standard interrupt 17 (the BIOS printer) calls and a few more. Here is a list of the additional functions supported by PCSPool. Note that for these calls, the printer number in dx is 0, 1, or 2 for LPT1, LPT2, or LPT3, respectively.

GET CONTROL BLOCK ADDRESS

Function C0h allows any program to look at the current status of a printer. The fields are laid out in the following program:

Entry: ah = C0h
dx = printer

Exit: es:bx contains the address of a printer control block.

The printer control block is an assembler structure whose format is shown in Figure S2.

BUILD PAUSE CONTROL RECORD

Function C1h allows a program to add a pause record to the queue of a specific printer.

Entry: ah = C1h
dx = printer
ds:si -> ASCII string to display

Exit: ah = printer status

When this record is encountered during printing, the printer stops and the supplied string is displayed in the control window.

FLUSH PENDING WRITES

Function C2h causes any data buffered in a queue record to be written to the queue or sent to the printer. As the BIOS print requests are intercepted, the data is placed in a temporary queue record. When the record is filled, it is automatically written to the queue. This call causes the record to be written regardless of how full the record is.

This function is used internally in the spooler when a control record (PAUSE or RESET) must be written to the queue. After the data is flushed, the PAUSE or RESET record can then be written to the queue.

Entry: ah = C2h
dx = printer

Exit: ah = printer status

CANCEL PRINTER QUEUE

Function C3h kills any data queued to the requested printer.

Entry: ah = C3h
dx = printer

Exit: ah = printer status

DETERMINE IF SPOOLER IS ACTIVE

Function C4h returns a unique value if PCSPool has already been loaded into memory.

Entry: ah = C4h

Exit: di = B0BFh if PCSPool is loaded
si = segment of the PSP of the active PCSPool

PCSPool RECORD FORMAT

```
lpstruc struct
lpptntr dw ? ; printer number
lpstatport dw 0 ; printer status port addr
lpfirstqr dw 0 ; first record on queue
lplastqr dw 0 ; last record on queue

lpptred dd 0 ; characters actually prt'd
lpinque dd 0 ; characters in spool

lpdqbuf dd 0 ; pointer to dq buf (puddle)
lpleat dd 0 ; last cnt of prt'd chars
lpticks dd 0 ; nbr ticks for prt'd chrs
lpdqin dw 0 ; offset of next char to put
; .. updated by main
lpdqout dw 0 ; offset of next char to prt
; .. updated by toprt

lpwrkqr dw 0 ; pointer to spooling qrec
lpspools db 90h ; current spooling status
lpstatus db 0feh ; current printer status
; 00 = ok
; 01 = not ready (hardware)
; 02 = paused w/message
; 03 = paused
; 04 = waiting init'ing
; fe = non-existent port
; ff = not currently spool

lpcontrol db 0 ; current ctrl record type
lpcps dw 0 ; observed printer speed
lpcbars dw 0 ; chars to send per service
lpwrite db 0 ; 1 = write need
lpflush db 0 ; 1 = flush all queued data
lptarflg db 0 ; 1 = update cps stats
lpstruc ends
```

Figure S2: The assembler structure for the printer control block.

Utilities

fects. If a graphics image created for a laser printer were redirected to an incompatible dot matrix printer, for example, the printout would be unrecognizable, and you might mistakenly suspect that either the printer or the spooling program was at fault.

PCSPPOOL: A LITTLE OF EACH

As the description of its various commands indicates, PCSPPOOL embodies elements of both individual and network-style spoolers. When PCSPPOOL is active it intercepts print data by taking over interrupt 17 (the BIOS print interrupt). If an application sends data to a printer by some other method (such as direct hardware I/O), the data will not be intercepted by PCSPPOOL. When interrupt 17 is called by the application program, PCSPPOOL determines whether the requested printer is spooled, and if it is, redirects the data to a queue record buffer for the requested printer. (Programmers will find a more complete discussion of the way PCSPPOOL makes use of this interrupt in the sidebar "Interrupt 17 Calls Added by PCSPPOOL.")

The records in the queue are placed in one of four linked lists: the LPT1 list, the LPT2 list, the LPT3 list, or the "free record" list. When data is to be written to the queue, a record is removed from the free record list, data is moved to it, and the record is placed on the list for the requested printer. Putting a record in a list involves only the movement of pointers: the data records do not move around in the queue!

Next, the timer interrupt invokes a routine that checks the status of each printer controlled by PCSPPOOL and determines whether data should be sent to it. If so, records are read from the printer's list in the queue. The data from the record is moved into a memory buffer and the record is then placed back on the free record list.

There is one exception condition that changes the normal data flow sequence. If a printer's record list is empty and its memory buffer has enough room to handle the data being spooled, the data is moved directly into the memory buffer. This eliminates the unnecessary overhead of moving the record through the queue during low-volume transfers.

QUEUEING AND DEQUEUEING

Asynchronous disk I/O is one of the most

difficult TSR functions to code. Because DOS is not reentrant, if one program has called DOS, another program may not call DOS until DOS has completed the first operation.

The difficulty this presents can perhaps best be seen by adopting the spooler's perspective when it is configured to maintain its queue on-disk. When an application requests a write to a printer via DOS, DOS then writes to the printer by using the BIOS routine interrupt 17. The spooler intercepts the data when interrupt 17 is called and places that data in a buffer. When the buffer is full, it must be written to disk so that the buffer can be used to capture more print data. To do this, however, the spooler must ask DOS to write the data to the disk queue. But it can't do this, because DOS is still busy!

If the spooler says to itself, "Very well, I will just buffer the data until DOS becomes available," it may have to deal with up to 64K of data (the maximum length of a DOS write) before DOS can accept a request to write to the disk queue. Moreover, most users don't want to give up 64K of memory to use as a temporary buffer.

The problem is avoided in PCSPPOOL by looking at all write requests issued via DOS interrupt 21, function 40h. When a write request is made, the spooler first issues a DOS IOCTL (function 44h) call to determine whether the device being written to is a printer. One of the many things the IOCTL DOS call can do is return information about the type of device represent-

ed by the file handle. PCSPPOOL looks for two pieces of information: (1) is the file a device, as opposed to a disk; and (2) is the file *not* the console?

If the file is either a disk or a console device, the write is passed on to the normal DOS interrupt 21 function, and PCSPPOOL takes no further action on that DOS call. If the file is a nonconsole, nondisk device, however, it is very possibly a printer. PCSPPOOL can't be totally sure yet, because there may be other nonconsole, nondisk devices in the system, such as COM1. Therefore, PCSPPOOL next determines the longest write that can be performed without overflowing a buffer it has established, and it issues a DOS function 40h to write that many bytes. If this causes a queue record to fill up, the remaining data is written as a series of DOS calls designed to fill a single queue record at a time. PCSPPOOL assures that all DOS writes to a printer are small enough to fit into its memory buffer by splitting large writes into a series of small writes.

As each record fills up, it's written to the queue until all the requested data has been written. Since no write will be larger than the room available in a queue record in memory, no more buffer space has to be allocated to assure that DOS will be available. And since PCSPPOOL has control of DOS interrupt 21 when write requests are made, it's able to overcome the DOS reentrancy problem and write a queue record to a disk-based queue file whenever it detects that a queue record has filled up.

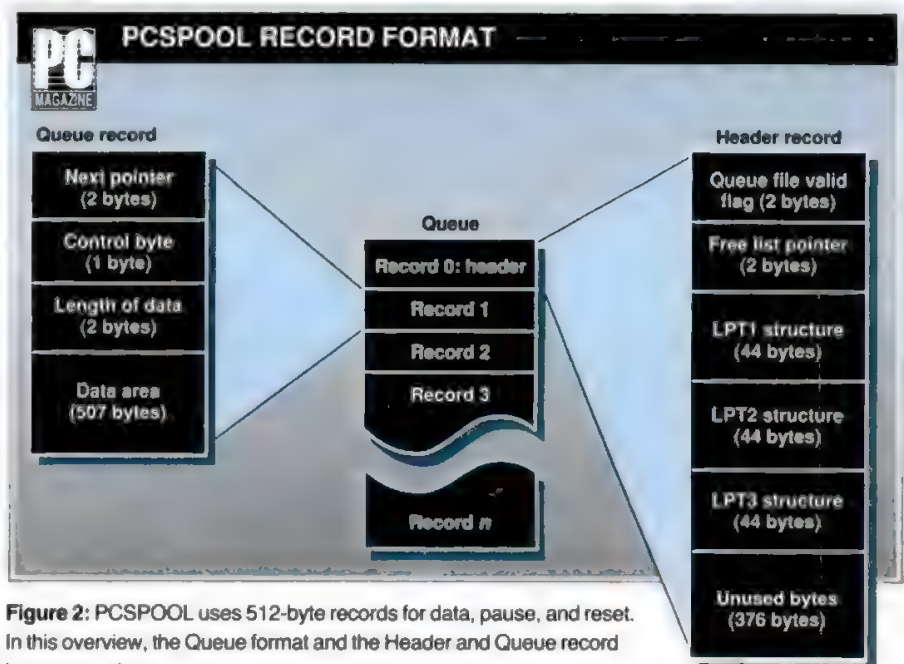


Figure 2: PCSPPOOL uses 512-byte records for data, pause, and reset. In this overview, the Queue format and the Header and Queue record layouts are shown.

Utilities

PCSPPOOL reserves a 1K temporary buffer for each printer attached to the computer. This is used during the trip from the queue to the printer. Whenever the data in this buffer falls below the amount of data held in a queue record (and DOS is available), a queue record will be read and the data will be moved to the buffer. Because the memory buffers are more than twice as long as the data area in a queue record, the data going from the queue to the printer is in effect double buffered. In other words, the printer is being serviced from a buffer that is effectively two queue records away

PC UTILITIES UPDATES

Like all good software, the programs presented in *PC Magazine* are upgraded and improved. The only way to obtain the modified versions is to download them from PC MagNet. Here is a partial list of the programs that have been upgraded:

ANSI.COM, Version 1.3
BEN55.ARC (Benchmark Series, Version 5.5)
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.2
DIRMATCH.COM, Version 1.1
EMS40.SYS, Version 1.1
LITES.COM, Version 1.1
LOG.COM, Version 1.1
PCMANAGE.EXE, Version 1.1

RN.COM, Version 2.0
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
TPFST-AT.COM, Version 1.1
ZCOPY.COM, Version 1.2

For a complete list of all the programs available from the PC MagNet Utilities Database, download UDCAT.ARC.

A downloadable index to *PC Magazine*'s product reviews is also available. PCM.EXE is a self-extracting file that contains *Computer Library's PC Magazine Reviews Index* for January 1988 to June 1990. It requires the search files in PCSRCH.EXE. Please read the information file PCM.INF before you download any of these files. ■

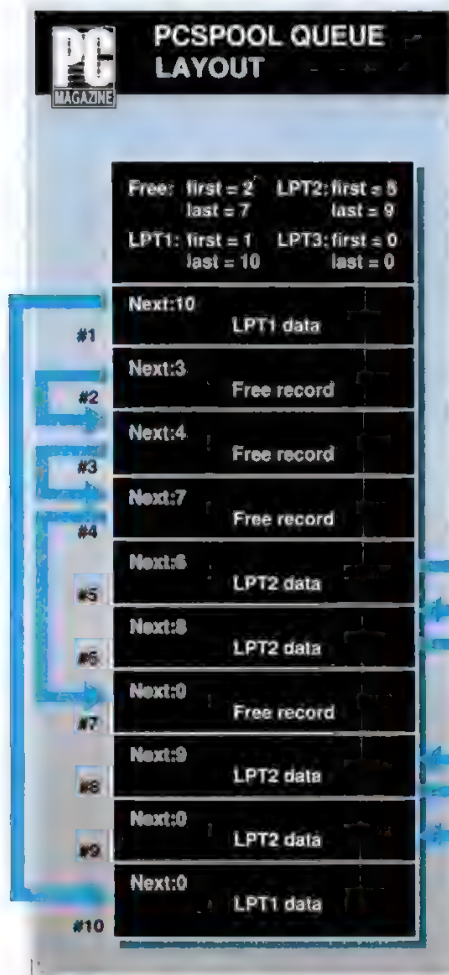


Figure 3: The first record in this short (11-record) queue is the header, which contains the base pointer for the lists of records that follow in the queue. The Free list contains records 2, 3, 4, and 7. LPT1's list contains records 1 and 10. LPT2's list contains records 5, 6, 8, and 9. There are no records on LPT3's list. Note that the last record in each list contains a zero for the next record pointer.

from being empty. This makes it less likely that the printer will run out of data because of a short delay in DOS availability.

Of course, when a memory queue is used, the DOS availability is not an issue. Since PCSPPOOL does not need to call DOS to write to the queue, it does not need to perform any special processing to assure DOS availability during interrupt 21 processing.

The size of the PCSPPOOL queue is limited by the memory allocated to it during initialization or by the free space available on the logical drive requested when the program was started. In either case, when no records are available on the free record list, new records are allocated at the end of the queue space until all available space is used up. When this occurs, the spooler returns a status code indicating that the printer is busy.

TECHNICAL TOPICS

The queue format consists of a series of 512-byte records, each of which contains a 2-byte next pointer, which points to the next record on the list; a 1-byte control byte that indicates whether the record is a data record, a pause record, or a reset record; a 2-byte data-length word; and a 507-byte data area. The first record (record 0) of the queue contains a header record that contains the anchors for the record lists in the queue. The record layouts are diagrammed in detail in Figure 2, and Figure 3 shows the relation among the records in a section of the queue.

When PCSPPOOL is initialized, the

header record is read into memory. If the spool was closed properly before shutting down the system and a disk rather than memory is used for the queue, spooling can resume from the place it left off before the system was shut down.

The program itself consists of three main sections: initialization, interrupt handlers, and queue handlers. The initialization section of the program is quite extensive and performs functions such as memory allocation and processing the initialization, pause, and uninstall commands before PCSPPOOL locks itself in memory and returns to DOS. The initialization code also sets up addresses for most of the TSR buffers and contains the code to issue error messages from the command errors.

When initialization has been completed, most of the code in the initialization section is overlaid with data buffers and one of the queue-handler routines described below.

The bulk of the TSR portion of PCSPPOOL consists of interrupt handlers. All of the code for the interrupts is contained in a single code segment and shares common data fields, memory buffers, and so on. Once PCSPPOOL is resident, all of its functions are invoked via interrupts.

The memory and disk queue-handler routines are located in separate segments at the end of the program. When the type of queue to be used is determined, the appropriate handler is moved to a portion of the TSR memory. The other handler is overlaid or released from memory.

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Michael Holmes and Bob Flanders

PCSPPOOL Command

January 15, 1991 (Utilities)

Purpose:

A TSR utility that spools files to be printed into memory or onto disk, freeing the PC and application for immediate use while printing takes place in the background. PCSPPOOL controls and displays status of up to three printers through command-line and window commands. Queued files can be skipped, canceled, and separated by form-feeds and pauses with prompt messages.

Format:

PCSPPOOL /I [/1] [/2] [/3] [/Cnn|/D[d:\path]]
PCSPPOOL /P [/1] [/2] [/3] [Comment]
PCSPPOOL /F [/1|/2|/3] PCSPPOOL /U

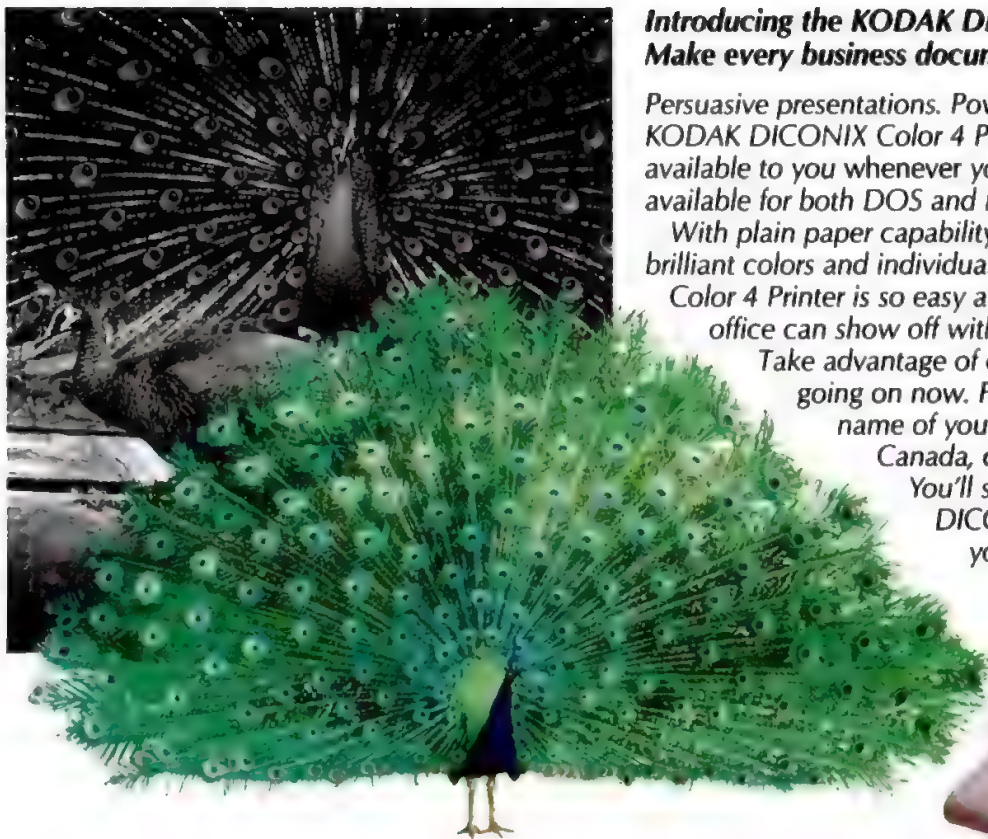
Remarks:

The /I (install), /P (pause), /F (form-feed) and /U (Uninstall) switches cannot be combined but must be executed separately from the DOS prompt. The optional numerals preceded by slashes indicate the printer port to be used. LPT1: is assumed if no entry is made, but printer(s) to be controlled can be changed in the pop-up window, whose default hotkey is Ctrl-Alt-P. The /C switch reserves *nn*K of conventional memory for the queue; default is 16K. Alternatively, a drive and path, including EMS RAM disks, can be specified with /Dd:\path. (Note: No space between /D and d:. The filename PCSPPOOL.QUE will be used.) A comment entered with the /P command (to change paper, for example) will be displayed when the pop-up window is activated. PCSPPOOL's TSR code requires 7K of memory.

Printers not specifically controlled by PCSPPOOL receive data normally; serial printers, even if set up with MODE LPTx:=COMx:, cannot be controlled by PCSPPOOL. Pauses and form-feeds should not be issued while data is being sent to the queue because their placement will be uncertain.

Single-letter commands to disable control (D), pause (P), send form-feed (F), reset printer (R), skip to next file (J), and flush the queue (C) are applied from the window to LPT1:. The same letters when used with Ctrl apply the function to LPT2:, with Alt they indicate LPT3:. The window Go (G) command takes control of a printer or ends a printer pause. (Two G commands will be required if both command-line and window pauses have been issued.) Printer status, amount of the queue being used by the printer (Gauge), printing rate (CPS), characters printed (CP), characters remaining in queue (CIQ), and time required to print the present queue contents are shown in the pop-up window.

Instructions for changing the hotkey and for downloading the program and its .ASM source code from PC MagNet appear in the Utilities column of the January 16, 1990, issue of *PC Magazine*.

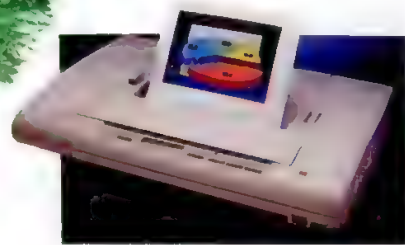


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Utilities

gram relatively device-independent. It is the responsibility of the handler to assure that data gets to and from queue records as requested. It makes no assumption about the contents of the records or queue. The only exception here is the management of record zero. In the case of memory queueing, where a shutdown and restart will not resume printing, there is no need to maintain record 0 in the queue, so this record is not written and the space is used to spool additional data.

If you wish to write another handler—for EMS or Expanded memory spooling, for example—it must follow these rules:

- The routine must be located in its own segment. The segment must be added to the DGROUP command at the top of the program.

It's the handler's job to ensure that data gets to and from the queue records as requested.

- The first 2 bytes of the segment must contain the length of the segment in bytes. The segment itself must be padded out, if necessary, to a multiple of 16 bytes.

- The third byte of the segment must contain a capital letter indicating which queue handler it is. Currently, C and D are used for conventional memory and disk handlers, respectively.

- The fourth byte must be the start of the code for the handler.

- The calls that the handler must accept are outlined in the comments that precede the disk queue handler in the .ASM listing.

The best type of spooler is one you don't notice. Your program sends data, your printer prints, and everything seems fine. It just happens a little faster when you use PCSPOOL. ■

Bob Flanders is president and senior systems analyst and Michael Holmes is vice president and senior systems analyst at NCI Systems in Annandale, Virginia.

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by
Charles Petzold

Environments

In the last issue, I showed how to select color under the OS/2 Graphics Programming Interface (GPI) using `GpiSetColor` and some other functions. The second parameter to `GpiSetColor` is a color index. Normally, the color index is one of the constants defined in the `PMGPI.H` header file that begins with the `CLR` prefix, such as `CLR_BLUE` and `CLR_DARKRED`.

You use the color indexes to select one of 16 standard colors. These 16 colors are familiar to anyone who has done character-mode programming for the IBM CGA, EGA, or VGA video boards, because they're derived from the 4-bit IRGB (intensity-red-green-blue) color encoding used on these adapters.

I also showed how you can use `GpiQueryRGBColor` to obtain the 24-bit RGB color value associated with each color index. A 24-bit color value consists of 3 bytes for the levels of red, green, and blue. (This value is stored as a 32-bit long integer with the most significant byte set equal to 0.) The complete mapping of color indexes to 24-bit RGB color values is known as the *logical color table*.

In addition, I showed how you can use `GpiQueryRealColors` to obtain the *physical color table*. The *physical color table* is the complete collection of 24-bit RGB color values currently available on the output device. These values correspond to the video adapter's palette registers as set by the presentation driver for the video board.

Only 16 colors can be displayed simultaneously on the standard IBM EGA and VGA boards when used in the high-resolution video mode required by the OS/2 Presentation Manager. Hence, the physical color table has 16 entries. Using the color indexes allows you to select any of these 16 colors.

However, the IBM 8514/A and some Super VGA adapters can display 256 colors simultaneously, so the corresponding physical color table has 256 entries. But using the color indexes allows you to select only 16 of these colors. The color

Showing Your Colors: GPI Functions for Implementing Color

■ Analog monitors can display many more than the standard 16 colors. Here's how your PM programs can access them.

indexes are certainly convenient for simple color selection, but they're inadequate for any extensive use of color.

In this issue we'll explore how to go beyond the standard 16 colors. This involves creating a new logical color table using the `GpiCreateLogColorTable` function. You can use this function to specify a different mapping of color indexes to 24-bit RGB color values and then use these new indexes in the `GpiSetColor` function. You can also use `GpiCreateLogColorTable` to create an RGB color table that allows you to use 24-bit RGB values directly in the `GpiSetColor` function. But before we create a new logical color table, let's examine how we can query it.

QUERYING THE LOGICAL COLOR TABLE

As I mentioned, the logical color table is the complete mapping of color indexes to 24-bit RGB color values. For any particular color index, you can obtain the 24-bit RGB color value by calling `GpiQueryRGBColor`. To obtain the complete logical color table (or a subset of it), you use the `GpiQueryLogColorTable` function. Generally, you'll need to preface a

call to `GpiQueryLogColorTable` with a call to `GpiQueryColorData`.

You begin by defining an array of three LONG numbers:

```
LONG alData[3] ;
```

You use this array as the last parameter to the `GpiQueryColorData` function:

```
GpiQueryColorData (hps, 3L,  
alData) ;
```

The third parameter can be set to less than 3 if you don't need all the information, but you'll almost always want it all. The function sets the three elements of the `alData` array. You can then index the array using three constants that begin with the prefix `QCD_LCT` (query color data for the logical color table).

The first element of the color data array can be obtained using

```
alData [QCD_LCT_FORMAT]
```

This particular value will be either `LCOLF_DEFAULT`, `LCOLF_INDRGB`, or `LCOLF_RGB`. The `LCOLF` prefix stands for logical color format. A value of `LCOLF_DEFAULT` indicates the default logical color table. This is what you'll get if you haven't created a new logical color table for the presentation space by calling `GpiCreateLogColorTable` or if you've used the `GpiCreateLogColorTable` function to reset the default logical color table.

A value of `LCOLF_INDRGB` (index-`RGB`) indicates that `GpiCreateLogColorTable` has been used to create a new

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logical color table that maps color indexes to 24-bit RGB color values. I'll show you how to do this shortly.

A value of LCOLF_RGB indicates that GpiCreateLogColorTable has been used to create an RGB color table in which you use 24-bit RGB values directly when setting colors. I'll also demonstrate how you do this.

You obtain the second and third elements of the color data array using

```
alData [QCD_LCT_LOINDEX]
```

and

```
alData [QCD_LCT_HIINDEX]
```

These two values are the lowest and highest color indexes in the logical color table. Depending on the format of the logical color table, they'll be set as follows:

Format	Low	High
-----	--	----
LCOLF_DEFAULT	0	15
LCOLF_INDRGB	?	?
LCOLF_RGB	0	0

The question marks for LCOLF_INDRGB indicate that the low and high color indexes depend on the range of indexes specified when the logical color table was created.

If the format is LCOLF_RGB, you already know everything there is to know about the logical color table. The RGB color table allows you to use 24-bit RGB values directly in the GpiSetColor function.

Otherwise, let's set a couple of variables using the second and third elements of the color data array:

```
lLo = alData [QCD_LCT_LOINDEX] ;  
lHi = alData [QCD_LCT_HIINDEX] ;
```

The number of entries in the logical color table can be calculated using

```
lNum = lHi - lLo + 1 ;
```

Actually, this may not be exactly the number of entries, because some of the indexes in the range between lLo and lHi may be undefined.

You can now allocate a block of memory

to store the logical color table

```
alTable = malloc (lNum *  
sizeof(LONG)) ;
```

where alTable is defined as a pointer to LONG. You pass this pointer as the last parameter to GpiQueryLogColorTable:

```
GpiQueryLogColorTable (hps, 0L,  
lLo, lNum, alTable) ;
```

On return, the alTable array will contain the 24-bit RGB color values associated with the color indexes ranging from lLo to lHi.

The general syntax of GpiQueryLogColorTable is

```
GpiQueryLogColorTable (hps,  
fOption, lStart, lNum, alTable) ;
```

The fOption parameter can be set to either 0L or LCOLOPT_INDEX. If the latter, then alTable will contain alternating color indexes and RGB color values. In this case, the memory block allocated for the color table must be twice as large and lNum must be doubled.

CREATING A LOGICAL COLOR TABLE

You can create a new logical color table for a presentation space by calling GpiCreateLogColorTable. This function is somewhat complex, so I'll begin with some examples.

Suppose you've spent years (perhaps almost a decade) programming in character-mode on IBM color video displays. The IRGB color encoding is so ingrained in your head that you simply can't use anything else. What you'll want to do is use GpiCreateLogColorTable to create a new color table that lets you use these IRGB values in the GpiSetColor function.

First, initialize an array that contains the 24-bit RGB values that correspond to the 4-bit IRGB color encoding:

```
static LONG alTable[16] =  
( 0x000000, 0x000080,  
0x008000, 0x008080,  
0x800000, 0x800080,  
0x808000, 0x808080,  
0x404040, 0x0000FF,  
0x00FF00, 0x00FFFF,  
0xFF0000, 0xFF00FF,  
0xFFFF00, 0xFFFFFF ) ;
```

after this is done, call GpiCreateLogCol-

orTable in the following manner:

```
GpiCreateLogColorTable (hps,  
LCOL_PURECOLOR,  
LCOLF_CONSECRGB,  
0L, 16L, alTable) ;
```

The second parameter is a flag that indicates you want the color indexes to map to pure (that is, undithered) colors. The third parameter indicates that the color table contains consecutive 24-bit RGB color values. The next two parameters indicate that the table begins at color index 0 and contains 16 entries. The alTable array is the last parameter.

You can now use IRGB color values in the GpiSetColor function. For example:

```
GpiSetColor (hps, 4L) ;
```

will be dark red.

Let's try another example. Suppose your program needs to incorporate various gray shades for filling areas. You would prefer to use color indexes that indicate the level of gray, beginning with 0 for black and ending with 16 for white. You can define the color table array like this:

```
static LONG alTable[17] =  
( 0x000000, 0x101010,  
0x202020, 0x303030,  
0x404040, 0x505050,  
0x606060, 0x707070,  
0x808080, 0x909090,  
0xA0A0A0, 0xB0B0B0,  
0xC0C0C0, 0xD0D0D0,  
0xE0E0E0, 0xF0F0F0,  
0xFFFFFFFF ) ;
```

then call GpiCreateLogColorTable:

```
GpiCreateLogColorTable (hps,  
0L, LCOLF_CONSECRGB,  
0L, 17L, alTable) ;
```

Notice that I didn't use the LCOL_PURECOLOR flag here. On video adapters, such as the VGA, that have only a couple of grays in the physical color table, you'll want to use dithered colors for the grays that aren't supported.

To restore the logical color table to its default values, you use

```
GpiCreateLogColorTable (hps,  
LCOL_RESET,  
LCOLF_CONSECRGB,  
0L, 0L, NULL) ;
```


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The GpiCreateLogColorTable function has the following general syntax:

```
GpiCreateLogColorTable (hps,  
    flOption, lFormat, lStart,  
    lNum, alColors) ;
```

The flOption parameter can be any combination (or none) of the following flags:

- The LCOL_PURECOLOR flag indicates that the color table should use only pure (undithered) colors. (*Dithering* is the process of combining pixels of different colors to yield simulated colors that don't exist in the physical color table.) GPI uses dithering only for filled areas or paths, not for the other graphics primitives (lines, text, markers, or images).
- The LCOL_REALIZABLE flag, which I'll discuss shortly.
- The LCOL_RESET flag indicates that you want to restore the logical color table to its default values. In this case, the lNum parameter can be 0L and the alColors parameter can be NULL.

The lFormat parameter must be one of the following:

- LCOLF_CONSECRGB indicates that the logical color table in the alColors array is a series of RGB color values associated with the color index beginning with the lStart parameter and continuing for lNum indexes.
- LCOLF_INDRGB indicates that the alColors array contains alternating color indexes and RGB color values. In this case, the lStart parameter is ignored and lNum must be doubled.
- LCOLF_RGB indicates that you want to create an RGB color table. In this case, the lStart, lNum, and alColors are ignored and can be set to 0 or NULL.
- The lStart parameter is of importance only at times when lFormat is LCOLF_CONSECRGB. It indicates the starting color index. And the lNum parameter is only important when lFormat is LCOLF_CONSECRGB or when it is LCOLF_INDRGB. It indicates the number of values in the alColors array. For LCOLF_INDRGB, lNum must be an even number.

You can create a logical color table piecemeal by using various values of lStart and lNum. However, the highest color index you use must not exceed the value

you obtain from the DevQueryCaps function using the CAPS_COLOR_INDEX parameter. This value will always be high enough to allow you to create a logical color table that supports all the colors in the physical color table.

THE RGB COLOR TABLE

Perhaps the most important—and certainly the most common—use of GpiCreateLogColorTable is to create an RGB color table. This lets you use RGB color values directly in the GpiSetColor function. You do this using either

```
GpiCreateLogColorTable (hps, 0L,  
    LCOLF_RGB, 0L, 0L, NULL) ;
```

or

```
GpiCreateLogColorTable (hps,  
    LCOL_PURECOLOR, LCOLF_RGB,  
    0L, 0L, NULL) ;
```

In the first case, GPI will use dithering to approximate colors not available in the physical color table. As I mentioned, GPI uses dithering only for filling areas and paths. In the second case, if an RGB color value passed to GpiSetColor is not in the physical color table, it will be approximated with one that is.

If you want to use dithering in some cases but not in others, you can create the logical color table as shown in the first example. When you want to use undithered colors, you can use GpiQueryNearestColor to get the nearest pure color that approximates an RGB color value. Pass this nearest pure color to GpiSetColor.

The PMGPI.H header file contains several constants for working with an RGB color table:

```
#define RGB_BLACK      0x00000000L  
#define RGB_BLUE      0x000000FFL  
#define RGB_GREEN     0x0000FF00L  
#define RGB_CYAN      0x0000FFFFL  
#define RGB_RED       0x00FF0000L  
#define RGB_PINK      0x00FF00FFL  
#define RGB_YELLOW    0x00FFFF00L  
#define RGB_WHITE     0x00FFFFFFL
```

After creating an RGB color table, you can use these constants directly in the GpiSetColor function:

```
GpiSetColor (hps, RGB_RED) ;
```

Unfortunately, PMGPI.H does not include a general macro for creating an RGB color

value from its three components, but you can define one easily enough, like so:

```
#define MAKERGB(r,g,b) MAKEULONG \  
    (MAKEUSHORT ((b), (g)), (r))
```

If you want a color that is 25 percent of the maximum red intensity, 50 percent of the maximum green intensity, and 75 percent of the maximum blue intensity, you use

```
GpiSetColor (hps, MAKERGB  
    (0x40, 0x80, 0xC0)) ;
```

If you'd like to explore the range of colors available using an RGB color table, the COLORSCR (color scroll) program in my book *Programming the OS/2 Presentation Manager* (Microsoft Press, 1989) lets you set RGB colors using scroll bars.

THE GPIERASE PROBLEM

When you're creating a new logical color table, watch out for the GpiErase function. GpiErase erases the background of a window using the color that corresponds to color index 0. In the default logical color table, color index 0 happens to be CLR_BACKGROUND, which is the window background color you set using the Control Panel. By default it is white.

In all the examples using GpiCreateLogColorTable I've presented here, the color table is defined with the color index of 0 corresponding to black. This seems a natural way to define a logical color table, because 0 is intuitively no color. However, windows with black backgrounds look ugly in a windowing environment. White is almost always used instead.

Of course, one way to get around this problem is to define the logical color table so that an index of 0 corresponds to white. But you can't do this when creating an RGB color table. A better alternative is to use WinFillRect or GpiBox rather than GpiErase to erase the window background.

PALETTES AND WINDOWS

As I discussed in an earlier installment in this series on color, most video adapters in common use today have some kind of palette control. For example, although the EGA can display only 16 colors simultaneously, these 16 colors can be chosen from a palette of 64 colors.

VGA and 8514/A video adapters use analog monitors and have more-extensive palette control. While these adapters can display only 16 or 256 colors simultaneously, the colors may be chosen from

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a palette of 262,144 colors. (That's 2^{18} : The palette registers use 6 bits each for the levels of red, green, and blue.)

The presentation driver is responsible for loading the palette registers on the video board. The complete set of 24-bit RGB values corresponding to the loaded palette registers is the physical color table obtained from `GpiQueryRealColors`.

It would be nice if the OS/2 Presentation Manager let an application change the physical palette. For example, a program running on a VGA may want to use eight undithered gray shades for reproducing a bitmap originating from a scanned image. (Bitmaps can't use dithered colors.) The program can't do this if it isn't able to change the palette. Even a program on the 8514/A may find some inadequacies in the palette. As I discussed in the last issue, the physical color table for the 8514/A is defined so that only four levels of blue are available, namely:

```
0x000000
0x000055
0x0000AA
0x0000FF
```

The first one doesn't even count, because it's black, which is not blue at all. If you need to display more shades of blue, all you can do is rely on the presentation driver to use dithering.

But changing the video board palette is also a problem. The OS/2 Presentation Manager is a graphics windowing environment. Multiple programs share the video display. The settings of the palette registers on the video board affect all programs running under PM. The palette is thus a limited resource.

Suppose that two PM programs are running on a VGA system. One program wants to use 16 shades of blue and the other wants 16 shades of gray. They can't be satisfied simultaneously.

The developers of PM have come up with two different solutions to this. The first approach was in OS/2 1.1 and is called the *realizable color table*.

REALIZABLE COLOR TABLES

The first shot at allowing the program access to the physical palette is through the `GpiCreateLogColorTable` function. If you include the `LCOL_REALIZABLE`

flag in the second parameter, then you're indicating you want the physical palette to be changed in accordance with the color table you've defined.

This change does not go into effect immediately after calling `GpiCreateLogColorTable`. Another call is required:

```
GpiRealizeColorTable (hps) ;
```

This function causes the presentation driver to load the video board's palette with values corresponding to the 24-bit RGB colors in the logical color table, thus changing the physical color table.

The OS/2 documentation states that `GpiRealizeColorTable` should be called only when the program's window is maximized to fill the whole screen. Any PM program that was using realizable color tables would trap a message (probably `WM_MINMAXFRAME`) indicating when the program was being maximized. It would then call `GpiRealizeColorTable`.

OS/2 2.0 has a new set of functions that allow programs to change the physical palette.

When the program's window was being restored or minimized, the program would call

```
GpiUnrealizeColorTable (hps) ;
```

This causes the presentation driver to restore the video board palette registers to their default values.

You'll recall from the last issue that some GPI color functions (namely, `GpiQueryColorIndex`, `GpiQueryNearestColor`, `GpiQueryRealColors`, and `GpiQueryRGBColor`) can accept an optional parameter named `LCOLOPT_REALIZED`. When this parameter is specified, these functions return information as if the logical color table were already realized.

There are several problems with realizable color tables:

The first is that realizable color tables were never really implemented. (You must admit that this is a serious problem if you want to use them!) Before a program at-

tempts to define a realizable color table, it should call `DevQueryCaps` with the `CAPS_COLOR_TABLE_SUPPORT` parameter and test the return value with the `CAPS_COLTABL_REALIZE` flag. If you do this, you'll find that no video display presentation driver supports realizable color tables.

The second problem is that the OS/2 documentation states that a program can change the palette only when the program's window has been maximized. However, a program could easily break the rule, and this might cause another program's window to look funny. Moreover, there might be cases where two programs use realizable color tables but in a compatible manner. These two programs should be allowed to be displayed side-by-side on the same screen and use the colors they want.

In addition, there has always been some question about how realizable color tables would affect system colors, such as those used in title bars, scroll bars, and menus. It's not inconceivable that changing the video board palette would render the text on a menu unreadable. This is because realizable color tables are only part of the GPI subsystem. The windowing subsystem doesn't know anything about them.

Finally, palette control can be used not only for selecting colors, but also for animation. The realizable color table just isn't adequate for this task.

Of course, these problems with realizable color tables were quite evident to the PM developers, and it appears now that realizable color tables are being phased out of the 32-bit API of OS/2 2.0. Although the functions are still documented in the second beta release of OS/2 2.0, a little snooping into the `PMGPI.H` header file reveals that the `GpiRealizeColorTable` and `GpiUnrealizeColorTable` functions are not defined for the 32-bit API.

THE NEW PALETTE MANAGER

Does this mean that we won't have any way to change the physical palette in OS/2 2.0? Not at all.

OS/2 2.0 has a new set of functions that allow programs to change the physical palette. These correct the deficiencies of realizable color tables. Most importantly, now this palette control is really being implemented. Although it's still a little buggy in the second beta release of OS/2 2.0, it works well enough to begin experimenting. I'll discuss OS/2 2.0's new palette manager in the future. ■

by
Ray Duncan

Power Programming

The Operating System Of the Future: The Readers Speak

■ Everyone agrees that we need a new operating environment—but that's about all they agree on.

August and the first two weeks of September 1990 were a stressful period for OS/2 developers. The bulletin boards and electronic mail services buzzed with speculation that OS/2 and Presentation Manager were about to disappear; *InfoWorld* ran a front-page story predicting a "great divorce" between IBM and Microsoft; and even the ordinarily staid *Los Angeles Times* ran a speculative article on the state of the relationship between the two companies. All this rumor-mongering culminated on September 17th, with the following press release from IBM:

"IBM today reaffirmed its relationship with Microsoft and extended its licensing arrangements for DOS, *Windows*, and OS/2. Also highlighted were a series of steps being taken to improve the efficiency and productivity of development efforts for DOS and OS/2.

"Although both IBM and Microsoft will define requirements for these products, each company's development efforts will primarily focus on certain products, which will be licensed to the other company. In most cases, development efforts will be centralized in one location. Concentrating development activities in single-site locations will increase overall development responsiveness, reduce development cycles, and enable streamlined migration and growth alternatives for users of DOS, *Windows*, and OS/2.

"Today's announcement clarifies the roles of both companies toward providing a range of operating platforms to meet the varied requirements of desktop customers," said James A. Cannavino, IBM vice president and general manager, Personal Systems. "By focusing IBM's development efforts in this manner, we are better able to achieve this goal."

"In order to improve the efficiency of development efforts, IBM will have the primary role for developing 16-bit and 32-bit OS/2, with Microsoft making development contributions. Microsoft continues to develop *Windows* and will be the primary developer for DOS. Both com-

panies intend to contribute to the development of a 32-bit version of OS/2 that is portable to other computer instruction sets, such as RISC (Reduced Instruction Set Computing). Microsoft will have the primary role of developing this portable version, with IBM making development contributions. All of these products will be cross-licensed by both companies.

"IBM also reaffirmed its intention to reduce the entry requirements for OS/2 to 2MB, to converge *LAN Manager* and *LAN Server* and to make the functions of OS/2 EE and *LAN Server* available to all IBM and OEM OS/2 users. In addition, IBM will begin delivering limited shipments of a 32-bit version of OS/2 to selected accounts in 1990, and the product will be generally available in 1991.

"The range of desktop operating products licensed by both IBM and Microsoft continues to meet the needs of most users. DOS, with more than 20,000 applications, remains a significant platform for entry-level systems with less than 1MB of memory and will be enhanced over time. *Windows* provides a graphical solution for users in a DOS environment. Designed for systems with 1MB or more of memory, *Windows* works well for users of personal productivity applications. A typical

system configuration for *Windows* would range between 2MB and 4MB.

"As an advanced-function operating platform, OS/2 offers full multitasking capabilities in a graphical environment. It is ideal for larger, more complex applications, such as mission critical and line-of-business applications and is recommended for servers. OS/2 is designed for systems with 2MB or more of memory and typically runs in a 3 to 6MB environment."

At the same time, Microsoft issued a supporting statement which read in part:

"We are excited about IBM's announcement today reaffirming our relationship and outlining the expansion of our cross-license agreement for present and future versions of DOS, *Windows*, and OS/2.

"Together, IBM and Microsoft will provide a family of PC operating systems that is compatible and scalable from entry level PCs to high-end, advanced PC platforms. Microsoft and IBM have played a key role in the development of the PC industry and we will continue to cooperate to provide the best operating system solutions to our customers."

Some analysts immediately seized upon these two press releases as evidence that the IBM/Microsoft Joint Development Agreement continued in perfect health, and a few journalists went so far as to claim that these announcements marked the beginning of a great new era for OS/2 and Presentation Manager. But one only has to think back to Microsoft's 1988 promise to release all new applications on PM first, or the infamous 1989 fall Comdex press release that relegated *Windows* to machines equipped with less than

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2MB of RAM, or the spring 1990 announcement that all OS/2 2.0 development was being transferred to Microsoft, to conclude that these latest documents should be regarded, at best, with a great deal of skepticism.

My own interpretation of these press releases is that they represent a last, desperate attempt to paper over irreconcilable strategic differences between the two companies. While puzzling over the two documents, I was reminded of a passage in one of the great old science fiction novels, where a computer analyzes an elaborate book-length treaty between two planets and dismisses it with the summary: "semantic content: zero."

Although IBM and Microsoft agreed to cross-license everything, they committed themselves to nothing in the way of *marketing* the cross-licensed products. The two companies freed themselves to go in their own directions and work on the projects that interested them most—like two yuppie parents with conflicting careers and interests who continue to live in the same condo for the sake of the children.

Reading between the lines (and assuming that the press releases actually have any intrinsic significance), I suspect that Microsoft took a hard look at the startling success of *Windows 3.0*, compared it with the dismal penetration of the desktop market by OS/2 after three years (less than 2 percent by the most optimistic estimates), and decided to cut its losses on PM and go where the money is. Microsoft did reserve an escape hatch for itself, however—if a market for OS/2 materializes, Microsoft can independently develop and ship the "portable" version of OS/2 with a protected-mode version of *Windows* as its graphical user interface, thereby protecting the installed base of *Windows 3.0*-compatible applications.

By the time you read this, we'll probably have a much better idea of IBM and Microsoft's true intentions. In any event, this great tempest in the OS/2 teapot occurred, by an uncanny coincidence, at almost exactly the same time as the appearance of my two columns "The Successor to DOS: A Look at Several Possibilities" (October 16, 1990) and "A Prescription for the Operating System of the Future" (October 30, 1990). Any lurking fears I may have had about whether anyone actually

reads this column were dispelled by the blizzard of e-mail that the two columns—in combination with Microsoft and IBM's latest startling U-turn on OS/2—provoked, so I've decided to present a small sampling from the Power Programming electronic mailbag:

DOS MIGHT BE GOOD ENOUGH

Your article in the October 30 issue is right on the money. Most of us don't need OS/2, at least until available OS/2 software becomes so good that it's irresistible; what we really need is a version of DOS that reflects the needs of today's software and users.

One thing this means is, let's stop worrying about PC-XTs. Yes, there is a huge installed base of 8086/8088 machines, but they aren't going to give acceptable performance with complex GUI applica-

Most of us don't need
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tions, no matter what version of DOS they use. XT owners would be adequately served if a good installation program were bundled with DOS 3.3.

The release of *Windows 3.0* indicates that Microsoft is betting heavily on software designed to use protected mode. The smart way for them to hedge that bet is to create a DOS which makes protected mode easily accessible.

Dan Hackett

THE GREAT DIVORCE

I enjoyed your recent article in the October 16 issue. It raises many provocative questions about where IBM and Microsoft are headed with DOS and OS/2. It appears to me that Microsoft is positioning itself to promote *Windows* and an upgraded DOS together as an easier successor to the current version of DOS than OS/2 will ever be. I'm an internal consultant for my company, and these two major competitors have made it very difficult to provide stable guidance to my clients.

They are causing a great deal of confusion for developers as well.

I'd be most interested to hear where you think these two companies are headed. Is the divorce real? Do you believe they'll stake out separate markets? What does Microsoft have to do to make DOS more functional? Can it, for example, reuse some of the work already done in OS/2, scaled down, to make DOS into a 32-bit operating system with some form of true multitasking ability (without starting legal action by IBM)?

There are still many important and fascinating questions to discuss on this subject. A follow-up that builds on your recent article would be a big help.

David Gardiner

AN UNHAPPY DEVELOPER

I've wanted to write a letter to Microsoft for some time, and your discussion in the October 16 issue finally prompted me to do it. I know I'm not the only one who is upset at the way things are going. Here's a summary of what I wrote.

I wanted to go on record with my feelings about the way Microsoft has treated me and other developers over the past few years in relation to OS/2 and *LAN Manager*. None of the feelings I expressed were directed at any individual. On an individual basis, everyone at Microsoft was extremely helpful and courteous.

In October of 1988 I purchased the OS/2 SDK from Microsoft for \$3,000. This isn't a small sum of money for me, and I don't believe other independent developers consider it small either. But I was convinced that OS/2 would be the operating system of the future (and I still feel that way), so I proceeded to learn as much as possible about the OS/2 and *LAN Manager* APIs and to write programs to run under those environments.

As time went on, though, I began to wonder. Microsoft claimed to fully support OS/2, but to this day the only OS/2 applications that Microsoft has released are a port of (character-based) *Word*, and a not very exciting *Excel*. There's no Presentation Manager version of *Word*, and there are no OS/2 retrieval programs for CD ROM. Even the software for Online wouldn't run in the compatibility box; in the early versions of OS/2 you had to reboot under DOS to call Online. (I don't know whether that has changed, because I haven't renewed my subscription.) And I don't think I need to comment about the situation with device drivers.

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I called Aldus to find out when it'll release an updated version of *PageMaker* to run under OS/2, Version 1.21. It couldn't give me an answer because of another "strategy change" between IBM and Microsoft.

And we've been told since the beginning that OS/2 and *Windows* were "coming together," that *Windows* applications would either easily port or run directly under OS/2. But, while Microsoft forged ahead with *Windows* and *Windows* applications, so far we've seen nothing to encourage us that these applications will run, unmodified, on a future version of OS/2.

To add insult to injury, we get to pay another \$2,600 for the pleasure of re-writing all of our programs—again—for Version 2.0.

In closing, I asked Microsoft to let us know if we've all been wasting our time and money, or if there really is a future with OS/2. I suggested that if Microsoft wants *our* continued support, it would have to make things a little easier for us. This means that we shouldn't have to pay \$2,600 for an upgrade to the next beta version. We shouldn't have to pay \$795 for *Online* to tell us why it doesn't work. And we need some real evidence that Microsoft is 100 percent behind OS/2.

John M. Brandes, Jr.

FUTURE DOS

I read your latest article in *PC Magazine* about DOS, OS/2, *Windows*, Unix, and possible successors to DOS. I have some thoughts on the subject as well.

- A new DOS should take advantage of the 386 and 486—more than just Virtual 86 mode. It should be able to use a 32-bit flat memory model.
- A new DOS needs better support for SCSI drives. And it would be nice to get rid of the limit of 1,024 cylinders for hard disks and allow up to 256 heads and 256 sectors per track.
- There should be a well-defined interrupt interface that is 32-bit efficient *and* compatible with DOS's present interrupt structure.
- DOS should support interrupt-driver serial communications with user-adjustable buffer sizes.
- Multitasking shouldn't be incorporated into DOS itself, but DOS should be reentrant and multitasking-friendly, with full

file- and record-locking, command queuing, and so on.

- DOS should offer the option of using HPFS-386 as its file system instead of the FAT system. This could be accomplished during installation, where users would choose which file system to use.
- DOS itself should run in 32-bit mode, not real mode, but should support Virtual 86 mode (like OS/2 2.0 I suppose).
- DOS should support a dynamic Cache/RAM disk/print spooler memory pool for speeding up disk access.
- DOS should have a fully editable command line with history available.
- Color should be supported in directory listings.
- DOS shells should be left to the after-market.

Microsoft forged ahead
with *Windows* and
Windows applications,
but there's no proof
that they'll run on a
future version of OS/2.

- CD-ROM drivers should come with the package.

I'd like to see a product that would combine DOS 5.0 with a 32-bit DOS Extender such as Phar Lap's DMPI-compatible extender, and include OS/2 2.0's file system and other enhancements. One thing is clear to me—a 16-bit DOS just won't do the job.

Andrew Eldritch

DON'T FORGET BATCH FILES

I think you left out an important area in your discussion of enhancing DOS—the MS-DOS batch file facility. It's really poor! If Microsoft checked with IBM, it would see that a new command-list language, REXX, is currently packaged with everything that goes out the door. A few years ago, *PC Magazine* reviewed Mansfield Software's version of PC/REXX. This implementation of REXX allows users to supplement DOS batch files with REXX programs.

It's obvious that *Windows* 3.0 is much

more competitive as a GUI, and I think the fact that it looks a lot like a CUA (Common User Access—the user interface for IBM's Systems Application Architecture) has helped also. Microsoft would do well to take this a step further and enhance DOS (and *Windows* too!) with SAA's procedural language—REXX.

Dennis Brown

A FAN OF QNX

Although I've been working in a DOS/*NetWare* environment for the past couple of years, your article reminded me again how much I miss *QNX*—multitasking, compact, fast, and clearly designed from the bottom up to achieve those qualities. Could *QNX* be the successor to DOS? Well, there are problems—the command-line interface is almost as arcane as Unix's, and *QNX*'s setup and configuration would baffle even more users than DOS's or even *Windows* 3.0's.

The difficulties with the command-line interface will be solved with the upcoming GUI, which promises to be much faster and smaller than *Windows*. And this interface can be server-based, so that network workstations will be able to use it even with limited memory.

It's the shortcomings of the PC platform, though, that cause the setup problems. PC-based operating systems require complex configuration files because the hardware of an ISA-bus PC (or an EISA-bus machine with any ISA cards in it) simply doesn't tell the operating system enough about itself for automatic configuration. There's a way out of this situation: develop an operating system for MCA machines only. (I suppose EISA-bus machines could be supported, too, but at the user's risk.) The drawback to this approach is obvious: you might come up with a very nice operating system, but nobody would buy it.

So what should the successor to DOS be? I'm pessimistic. I don't think we'll ever see a first-rate operating environment for PCs combining power, flexibility, and simplicity. Eventually, we'll all probably move to another platform.

Andy Jerison

AN UNHAPPY CAMPER

I normally enjoy reading your column, but I've just finished the latest (October 16, 1990) and I feel compelled to write to you. I think the column was as egregious an example of opinion-posing-as-fact as I've ever seen in your magazine. Here are

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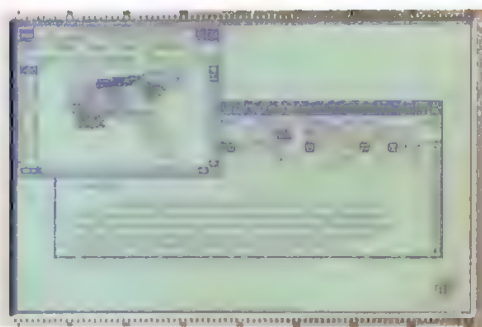
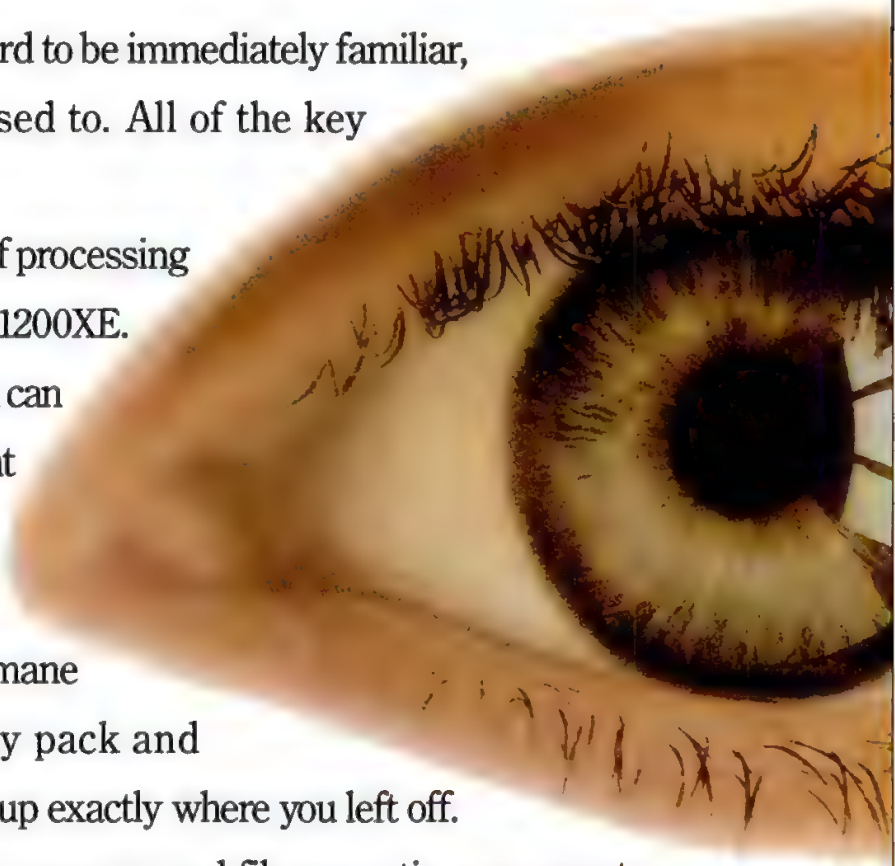
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some of my problems:

"I suspect that they also shied away from DOS 4.x as a gut reaction to all the hype that surrounded its release. . . ."

The very same reaction that you have no doubt perceived to *Windows 3.0*.

"The name OS/2 demonstrates no obvious lineage from DOS."

You had just finished trashing DOS 4.x because of incompatibilities with DOS 3.3 when you wrote this. Are you seriously trying to promote the old saw that OS/2 should have been called DOS 6? How do you think the marketplace would have reacted to *those* incompatibilities?

"The name OS/2 . . . is in fact much more reminiscent of . . . IBM's traditional operating system behemoths for mainframes, such as OS/MVS."

There is, of course, no such operating system as OS/MVS. Perhaps you were thinking of the old OS/MFT or OS/MVT, or MVS/XA. What you fail to note is that IBM's most popular mainframe operating system since 1965 is called—you guessed it—DOS! Clearly, this has led to enormous confusion in the PC marketplace.

"The straight port of *Windows* to protected mode was abandoned in favor of a new, extremely complex, nonoptional graphical user interface known as the Presentation Manager."

Are you suggesting that if *Windows* had been chosen, it would have been optional such that other, alternative GUIs would be available? You are surely *not* suggesting that OS/2 programs can be written only in PM, as you've gone to some trouble to write a popular book on non-Presentation Manager OS/2 programming. You're certainly stretching implications to the limit to suit your own rhetoric.

"The PM was largely designed at IBM in Hursley, England, the same IBM site that was responsible for IBM's Future System debacle in the 1970s."

I feel that this is your most reprehensible statement. A real journalist, writing in a real newspaper and armed with real facts, would never stoop to such innuendo. FS as a commercial project was over in 1975, 15 years ago by my reckoning. Are you saying that there's some kind of curse over Hursley? Your statement reveals a lack of understanding of even the most basic concepts of causality, let alone responsible journalism.

The list goes on, but I must add that I deplore the policies of *PC Magazine's* editors in allowing such "shock schlock" to be published. It's not the first time that your magazine has published columnists whose desire to be controversial totally subsumes their responsibility to be factual. Unfortunately, I have no say in what *PC Magazine* publishes. But I can vote with my pocketbook, I can cancel my subscription, and I can decline to buy your next book.

Mark Florence

[You're right, I was thinking of OS/MVT; the OS/MVS was an unfortunate slip of the keyboard. As for Hursley, my grasp

Perhaps the needs of the PC industry are at the point where more than one operating system is required.

of causality is just fine, thank you—it's a fact that concepts and developers involved with the Future Systems debacle *were* inherited by the OS/2 Presentation Manager project—RD.]

WHY DID OS/2 GET SO BIG?

As usual, IBM displayed its "bigger is better" philosophy in the development of OS/2, and I can't help but wonder why Microsoft let it influence the design of OS/2 so heavily. Your explanation of why Microsoft let IBM have DOS 4.x also begs the question of why Microsoft had given up on DOS in the first place.

I think Fred Brooks's description of the "second system syndrome" [in his book *The Mythical Man-Month*] is relevant to all of this. In fact, the name OS/2 might be viewed as a direct expression of this syndrome! I also think that IBM's overblown plans for OS/2 intersected people at Microsoft at a time when they wanted to design their "second" OS/2 as a "real man's" operating system.

It's a real shame that OS/2 apparently won't make it, because there's so much good stuff in there. Maybe that was exactly the problem: too much stuff in it,

but not necessarily the stuff anyone wanted.

Andrew Schulman

ONE DOS, MANY SUCCESSORS?

I agree with you that something must succeed the current version of DOS. As you've already stated, DOS is no longer an adequate operating system for the current (and future) environment of the PC platform. But I—and many of my peers—feel that a single PC operating system may no longer be sufficient. Does this sound ludicrous? I don't think so.

In comparison with the supercomputer/mainframe/mini world, the PC world is still evolving. It is, at most, in its adolescence. If you look at the IBM mainframe environment, you'll note that there isn't a single or even a couple of standard operating systems. There's MVS, VM, VSE, DOS (mainframe version), and AIX. If you look further, you'll see there are even variations of each of those operating systems! (MVS/370, MVS/XA, MVS/ESA, VM/SP, and VM/HPO are some examples.)

The supercomputer and minicomputer world is as diverse as the mainframe world. Why do they have so many operating systems? Because different needs spawn different responses. The point is that perhaps the PC world is just now maturing (regressing?) to the point where the needs of the industry require more than one operating system.

Every time I read a trade publication or speak to proponents of one operating system or another, there seems to be an obsession with using *one* operating system. Do we all drive Ford Escorts? Of course not. Don't get me wrong, it would be nice to have a single do-it-all operating system (maybe we can ask those guys that make the Ginsu knives that slice-and-dice to come up with something handy)—but users' needs are so diverse that it's unlikely to happen.

Eugene Lew

A SINISTER PLOT?

I read your October 16 column on operating systems and almost cried. It sounded like the death knell for OS/2. I, too, have been depressed by all of the machinations and maneuverings of Microsoft and IBM over the OS/2 problem, and I'm just about convinced that Microsoft murdered OS/2 deliberately.

Here's my reasoning: Over the last two or three years, Mr. Bill has been exhorting us (and other application providers, like Lotus and WordPerfect) to forgo the

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short-term temptation of *Windows* and go directly to OS/2. Now it turns out that Microsoft has *not* been focusing on making OS/2 successful, but rather on enhancing *Windows* and creating applications for it.

So . . . what's wrong with this picture? Microsoft's competitors have all been neatly sidetracked to an operating system which just might die, and all of Microsoft's applications are now on *Windows*—the very environment it told us not to bother with—and it has the market all to itself.

If I were Manzi or Mr. Perfect, I'd be conferring with my ambulance-chasers this instant. And I'd slap Microsoft with an anticompetition restraint-of-trade class-action suit that would make AT&T's breakup look like a family outing. If these guys do it, I'll stand up and cheer. Perhaps the Atari ST was the answer after all!

Joe Barnhart

POSTCARDS FROM THE EDGE

You're alone now, Ray. I just repartitioned and formatted my 386/25 OS/2 system and gave it back to DOS and *Windows*. I don't know how many people will appreciate this, but the first time I printed from *Word for Windows*, a pretty, evenly formatted document emerged from the network laser printer I requested. I believe I ran OS/2 1.x on my machine for about 20 months without experiencing that pleasure. I now have access to dozens of major applications and utilities from Microsoft and other companies, plus the fellowship of millions of productive users worldwide. It's strange coming back from the edge—no one wants to hear my stories about configuring *LAN Manager* servers or about the merits of named pipes or *DosMuxSemWait*. I feel I've lost my identity and my individuality. I can, however, play solitaire in my spare time.

Join us, Ray. We are the world, we are the children. . . .

A Microsoft Employee

(Name withheld to protect the innocent.)

THE IN-BOX

Please send your questions, comments, and suggestions to me at any of the following e-mail addresses:

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by
William S. Hall

Windows

MULTIPLE DISPLAYS IN WINDOWS 3.0

I need to run *Windows* 3.0 with different screen drivers for different programs, and I use three types of displays: 640 by 480 with 256 colors; 800 by 600 with 16 colors; and 1,024 by 768 with 16 colors. I have the appropriate drivers and all of them work, but I can't switch easily between them. Right now, I have to reinstall *Windows* with the driver I want each time. Otherwise, I have to create three directories, each with a full version of *Windows* containing a different configuration. How can I install all three in one place and then just copy the files pertaining to a specific driver over to the main *Windows* directory? In this way, I could start *Windows* using the driver I want.

Alfred Ricks, Jr.
Angleton, Texas

PC You can indeed change drivers without setting up three versions of *Windows* or continually reinstalling different drivers. Moreover, *Windows* 3.0 makes these driver switches easier to implement than did earlier versions of the operating environment. (To perform similar procedures in *Windows* 2.x, see the *Windows* column in the September 25, 1990, issue).

You have a couple of options in the way you create multiple configurations, but you can install the drivers you need in the quickest and easiest way if you go directly through setup. This method assumes that your display drivers come with *Windows* and are listed in *SETUP.INF*, an ASCII text file located in the */SYSTEM* subdirectory of *Windows*. (If you have third-party drivers, you can make changes to *SETUP.INF* or maintain multiple *.INI* files. I'll discuss both techniques further on.)

To illustrate the first method, I'll show you how to configure a "triple threat" version of *Windows*, which can run VGA, EGA, and Olivetti/AT&T 640-by-400 monochrome modes. (Your video adapter

■ **MULTIPLE DISPLAYS IN WINDOWS 3.0:** You don't have to continually reinstall *Windows* or set up different WIN3 directories to switch between display drivers.

must support all three modes.) Assuming that your version of *Windows* is already configured for VGA, you'll need to add the other two drivers.

To add EGA, run Setup from *Windows* and select Change System Settings, found under the Options menu. Choose the EGA option and click on OK. Setup will now ask you to insert several disks containing the various support files. These include, by the way, a new set of typographic fonts as well as the display driver, new system fonts, and the old application support modules. When done, select the Restart *Windows* option and voilà, an EGA version of *Windows* will appear. To install the monochrome display, repeat all the steps listed above, choosing a 640-by-400 option—rather than EGA—from the list.

With all the necessary files for the three drivers on the hard disk, you can switch easily from display to display, whether in *Windows* or in DOS. Just run Setup and choose the video display you want. Setup finds the correct files and makes the conversion. You need only restart *Windows*. If you're in DOS, remember to run Setup from the *\WINDOWS* directory; otherwise, Setup thinks you want to set up a new copy of *Windows*. From either environment, the whole process takes about a minute and a half to complete.

As I explained earlier, this procedure works effortlessly if the display drivers involved are listed in *SETUP.INF*. *SETUP.INF* contains a complete list of all the components that *Windows* needs for a particular configuration, along with information about their dependencies. For example, the display driver you select determines which screen fonts, logo, and old application support modules *Windows* will install. As long as Setup can read the information stored there, you can easily switch from one configuration to another.

However, if you're using third-party drivers not described in Setup, you must try either of two procedures that allow you to switch conveniently from display to display. The more versatile of the two

VIDEO SEVEN VGA DRIVER ENTRY IN SETUP.INF

```
[display]
; The string following the driver description specifies the screen
; resolution. It is used to match the system and OEM character sets
; with the display selection.
;
;profile = driver, Description of driver, resolution, 286 grabber,
;logo code, VDD, 386grabber, ega.sys logo data
;
v7vga = 1v7vga.drv, "Video Seven VGA with 512K", "188,96,96",
3ivgacolor.gr2, 2ivgalogo.lgo, x1:vddvga, 4:v7vga.gr3,, 2ivgalogo.rle

[V7VGA.GR3]
4:CGA48WOA.FON,4:CGA48858.FON
4:CGA88WOA.FON,4:CGA88858.FON
4:EGA48WOA.FON,4:EGA48858.FON
4:EGA88WOA.FON,4:EGA88858.FON
```

Figure 1: The *Windows* *SETUP.INF* contains all of the files necessary to install and run a particular hardware configuration. The typical display entry here lists the Video Seven driver and all its auxiliary files. The entries user [V7VGA.GR3] lists the fonts needed to support older applications under 386 enhanced mode.

Windows

methods asks you to modify SETUP.INF directly; this procedure requires a fairly detailed knowledge of all the interrelationships among certain files, plus a clear understanding of the characteristics of the display itself. But once you've modified SETUP.INF, *Windows* will automatically execute all the steps necessary to switch from one display to another.

To begin, you must insert entries for all the drivers you'll be using into the [display] section of SETUP.INF. Figure 1 shows a typical entry—a Video Seven VGA display. Note that this driver is included with *Windows*. The first file listed

```
1:v7vga.drv
```

indicates that the driver, called V7VGA.DRV, is located on disk 1. A text description of the driver follows; you'll see this description used in the Setup screen or dialog box.

The next entry

```
100,96,96
```

which lists the resolution, is perhaps a bit mysterious. The two values of 96 indi-

cate, respectively, the vertical and horizontal dots per *logical inch*. The first value is simply the ratio of the resolutions multiplied by 100. But before we go on, the term *logical inch* may need some explaining.

A *logical inch* has nothing to do with

To set up *Windows* so that you can switch among multiple displays, you add the required driver entries to SETUP.INF.

the display. Thus 640/6.6 equals (about) 96.7 dots per (logical) inch. Now, if the aspect ratio of your display is 1:1, then the vertical dots per logical inch is also 96. Thus, on a VGA or EGA display a logical inch is really about 1.2 to 1.3 actual inches. On a printer, a logical inch and a real inch are the same.

Windows uses this ratio to match the driver with the appropriate system, fixed, and OEM fonts. The program also uses this ratio to choose the typographic fonts appropriate for the driver. Figures 2 and 3 show the SETUP.INF entries for system, fixed, OEM, and typographic fonts that the Video Seven VGA would use. Note that a resolution string is added to the end of each font entry.

The entry after the resolution string

```
3:vgacolor.gr2
```

is the grabber file, located on disk 3. This grabber is needed to support the old application interface in standard mode. The name and location of the boot-up logo file follow.

The next entry

```
x:*vddvga
```

stands for "virtual device driver VGA"; this driver helps to select the *Windows* virtual machine. The x is used for internal consistency, helping Setup read the line. The last entries list files needed for 386 support of old applications.

When you run an old application in a window, you need to provide a font that simulates the ones you can see in full screen. Typically, you should have fonts that display both 40 and 80 characters on a line. The particular ones you need are related to the grabber file V7VGA.GR3.

The name *grabber* has existed since *Windows* 1.0. Possibly it was called that because then its main function was to be able to save and restore the old app screen as well as to save and restore its state when switching to and from *Windows*. The functionality is now much broader, but old names persist.

The grabber file supports full screen operations of standard applications. They have to be written specifically for a given display. They are completely hardware dependent, although for closely related hardware such as VGA and EGA, they might be the same file. Since Video Seven does supply a driver on the *Windows* setup disks, the grabber they need for

SYSTEM, FIXED, OEM FONT ENTRIES FOR VGA IN SETUP.INF

```
; If a display adapter other than the one in system selection is selected
; the font is chosen which matches the display resolution exactly.
[sysfonts]
1:vgasys.fon,"VGA (640x480) resolution System Font", "100,96,96"

[fixedfonts]
1:vgafix.fon,"VGA (640x480) resolution Fixed System Font", "100,96,96"

[oemfonts]
1:vgaoem.fon,"VGA (640x480) resolution Terminal Font (USA/Europe)", "100,96,96",1
```

TYPOGRAPHIC FONT ENTRIES IN SETUP.INF

```
[fonts]
4:HELVE.FON, "Helv 8,10,12,14,18,24 (VGA res)", "100,96,96"
4:HELVF.FON, "Helv 8,10,12,14,18,24 (8514/a res)", "100,120,120"
4:COURE.FON, "Courier 10,12,15 (VGA res)", "100,96,96"
4:COURF.FON, "Courier 10,12,15 (8514/a res)", "100,120,120"
4:TMSRE.FON, "Tms Rmn 8,10,12,14,18,24 (VGA res)", "100,96,96"
4:TMSRF.FON, "Tms Rmn 8,10,12,14,18,24 (8514/a res)", "100,120,120"
4:SYMBOLF.FON, "Symbol 8,10,12,14,18,24 (VGA res)", "100,96,96"
4:SYMBOLF.FON, "Symbol 8,10,12,14,18,24 (8514/a res)", "100,120,120"
```

Figures 2 and 3: These system, fixed, OEM, and typographic fonts listed in SETUP.INF support the Video Seven VGA driver. Note that the resolution strings at the end of several entries match the resolution string of the V7VGA entry listed in Figure 1.

Windows

their hardware is already present. Finally, we see an additional file needed for the boot-up logo. The corresponding font entry for V7VGA.GR3 is also shown in Figure 1.

To set up your program for multiple drivers, you'll have to add the entries (like the one described above) for all the displays that you want to use. You should use Notepad, Edlin, or any other text editor that can save files in ASCII format. (But please be sure to back up this file before you do anything else.) Figure 4 shows display entries for all the Video Seven drivers. Most of these entries replace the disk number with a: for the driver entry. These drivers are not included with Windows 3.0. When Setup does not find the file in the system directory, it will ask for the file and then default to drive a:. Note that for the 1,024-by-768 driver, I have taken the liberty of asking for an 8514/A font by specifying the device resolution to be 100,120,120.

Once you have inserted all the entries

ALL VIDEO SEVEN DRIVER ENTRIES

```
[display]
; The string following the driver description specifies the screen
; resolution. It is used to match the system and OEM character sets
; with the display selection.
;
;profile = driver, Description of driver, resolution, 286 grabber,
;logo code, VDD, 386grabber, ega.sys logo data
;
v7vga = 1:v7vga.driv, "Video Seven VGA with 512K", "100,96,96", 3:vgacolor.gr2,
2:vgalogo.lgo, x1:vddvga, 4:v7vga.gr3,, 2:vgalogo.rle
v7751256 = a:v7512256.driv, "Video Seven VRAM VGA 720x512x256 colors", "100,96,96",
3:vgacolor.gr2, 2:vgalogo.lgo, x1:vddvga, 4:v7vga.gr3,, 2:vgalogo.rle
v754016 = a:v754016.driv, "Video Seven VGA 720x540 16 color", "100,96,96",
3:vgacolor.gr2, 2:vgalogo.lgo, x1:vddvga, 4:v7vga.gr3,, 2:vgalogo.rle
v768016 = a:v768016.driv, "Video Seven VGA 800x600 16 color", "100,96,96",
3:vgacolor.gr2, 2:vgalogo.lgo, x1:vddvga, 4:v7vga.gr3,, 2:vgalogo.rle
v776816 = a:v776816.driv, "Video Seven VGA 1024x768 16 color", "100,120,120",
3:vgacolor.gr2, 2:vgalogo.lgo, x1:vddvga, 4:v7vga.gr3,, 2:vgalogo.rle
```

Figure 4: To use all Video Seven drivers with Windows, you must type their entries into SETUP.INF as shown above. Not all drivers listed here come with Windows.

needed, you can use Setup to install and change the various drivers. It will be best if you run Setup from DOS when you're moving to or from the 1,024-by-768 driver. For some reason, when you deinstall this driver from Windows and then replace it with one of the VGA drivers, the 8514 typographic screen fonts (COURF.FON, TMSRF.FON and so on) are not properly restored to those for the VGA. The system fonts, however, are set up correctly. If you

run Setup from DOS, you will not have this problem.

It may be difficult to locate all the necessary information to carry out the steps for modifying SETUP.INF. The Video Seven drivers are fairly easy to do, because most of the files needed are already on the Windows distribution disk. All you need to add are the drivers for the various resolutions along with the additional display entries in the .INF file. In

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Windows

other cases, you may have to turn to the hardware manufacturer who, in any case, should be ready to supply you with the information you need.

You can make your job easier with the EXEHDR utility, which comes with several Microsoft language products (C, Assembler, BASIC, and Pascal). EXEHDR can examine the descriptor string at the beginning of the driver entry. In this way the program can help you select the correct font resolution.

As I mentioned before, there is an alternative approach that does not ask you to modify SETUP.INF: You can store multiple setups right in your \WINDOWS directory. This method asks you to make changes directly to your WIN.INI and SYSTEM.INI files.

Begin with a base setup. Then copy WIN.INI and SYSTEM.INI to files with names that remind you of the display driver you are using. For instance, if you are currently using a VGA, you might want to use the names WININI.VGA and

SYSINI.VGA. Now, follow the instructions for changing the display driver. This may involve running the manufacturer's installation program, if provided, or simply copying files to the SYSTEM directory and using an editor to change entries in the .INI files as instructed. Do this right in your current \WINDOWS directory; there is no reason to make a new setup in another place. Test your installation, and when you're satisfied with it, copy the modified SYSTEM.INI and WIN.INI to files with names that remind you of the

**EXEHDR can examine
the descriptor string at
the beginning of the
driver entry and thus
can help you select the
correct font resolution.**

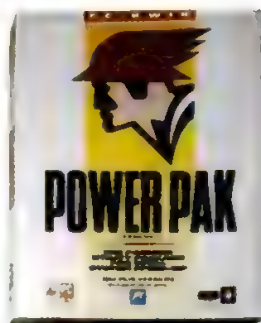
new display. Now you can switch from one display to another by copying the corresponding .INI files back to SYSTEM.INI and WIN.INI while in DOS and then running *Windows*.

While this second method may be appealing, it carries some limitations. When you install other software packages to use with *Windows*, the programs may modify your .INI files. Naturally, if you keep multiple .INI files, the modifications will affect only the one that you are using at the time. These changes will not show up in the .INI files for the other displays. Hence, although you will have a simple means for moving among various displays, you may find yourself from time to time having to hand-modify the several .INI files in order to keep up with changes in your system.

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Trudy Neuhaus

Databases

CREATING .DBFs ON THE FLY

When distributing code for a compiled application, it's invaluable to have your entire program in one self-contained file. This way, you never have to worry that one or more of the files required to run your program might be forgotten. As you probably know, this is more easily said than done. To give your program to someone else, you have to remember to give him the .DBF files, the .MEM file, the .FRM files, and so on, along with the .EXE file.

The BASIC program shown in Figure 1, MAKECLIP.BAS, analyzes a file and then creates a *Clipper* program procedure that will re-create that file. When you run the MAKECLIP.BAS program, you are asked to respond to three simple questions: the name of the file (.DBF is the default extension), the procedure file to append the procedure to (.PRG is the default extension), and the procedure's name.

To use the procedure in your program,

■ CREATING .DBFs ON THE FLY: MAKECLIP combines all your source files into one executable file for distribution.

use one of these two formats:

```
DO procedurename WITH "filename"
```

or

```
DO procedurename
```

If you use the first method, the file will be re-created with the filename you specify. The second method re-creates a file with the same name as the original file.

Although I originally intended the program for .DBF files, it can be used with virtu-

ally any file, such as an .LBL or .FRM file. However, I would recommend you only use it with small files, say under 2K, and not on files that programs can easily produce, such as .MEM and index files. Otherwise, you'll end up with some pretty long procedure files.

There's no reason the database must be empty before MAKECLIP analyzes it. However, any records in the database will also be in the database when it's re-created.

J. Kevin Wells
Yarmouth, Nova Scotia
Canada



Packaging an application for distribution means providing a way to re-create several files. Usually, at a minimum, there's the executable program (.EXE) and the database files (.DBF). The MAKECLIP program lets you package the .DBF and .EXE files to-

MAKECLIP.BAS

COMPLETE LISTING

```
10 MAKECLIP.BAS Clipper Version
20 Generate a procedure to recreate a .DBF or other file
30 CLS
40 ALPHAS = "abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ"
50 ALPHAS = ALPHAS + "XYZ1234567890"
60 LINE INPUT "Database file to read: ", S$
70 IF INSTR(S$, ".") = 0 THEN S$ = S$ + ".dbf"
80 ON ERROR GOTO 740
90 OPEN S$ FOR INPUT AS #1
100 CLOSE #1: ON ERROR GOTO 0
110 LINE INPUT "Procedure file to append to: ", T$
120 IF T$ = "" THEN T$ = ".prg"
130 IF INSTR(T$, ".") = 0 THEN T$ = T$ + ".prg"
140 LINE INPUT "Procedure name: ", P$: IF P$ = "" THEN P$ = "PROC"
150 OPEN S$ FOR RANDOM AS #1 LEN = 1
160 FIELD #1, 1 AS A$: FL = LOP(1)
170 GET #1, FL: IF A$ = CHR$(26) THEN FL = FL - 1
180 OPEN T$ FOR APPEND AS #2
190 PRINT #2, "PROCEDURE "; P$
200 PRINT #2, "PARAMETER P_TMP"
210 PRINT #2, "NL=CHR(0)"
220 PRINT #2, "IF PCOUNT()=0"
230 PRINT #2, "SET ALTERNATE TO "; S$
240 PRINT #2, "ELSE"
250 PRINT #2, "SET ALTE TO &P_TMP"
260 PRINT #2, "ENDIF"
270 PRINT #2, "SET ALTERNATE ON"
280 PRINT #2, "SET CONSOLE OFF"
290 PRINT #2, "?? ";
300 LC = 0
310 FOR Y = 1 TO FL
320 GET #1, Y
330 LC = LC + 1
340 IF A$ <> CHR$(0) THEN 490
350 IF Y = FL THEN GOTO 650
360 NLCNT = 0
370 WHILE A$ = CHR$(0)
380 NLCNT = NLCNT + 1
390 Y = Y + 1
400 GET #1, Y
410 IF Y = FL THEN GOTO 460
420 WEND
430 Y = Y - 1
440 PRINT #2, CHR$(34); MID$(STR$(NLCNT), 2) + " "; GOTO 660
450 PRINT #2, "REPL(NL," + MID$(STR$(NLCNT), 2) + " "; GOTO 660
460 IF INSTR(ALPHAS, A$) = 0 THEN 650
470 PRINT #2, CHR$(34);
480 QCNT = 0
490 WHILE INSTR(ALPHAS, A$) <> 0 AND Y <= FL
500 QCNT = QCNT + 1
510 IF QCNT > 50 THEN GOSUB 810
520 PRINT #2, A$;
530 Y = Y + 1
540 GET #1, Y
550 WEND
560 Y = Y - 1
570 PRINT #2, CHR$(34);
580 IF Y >= FL THEN 670
590 LC = LC + INT(QCNT / 10)
600 IF LC > 7 THEN LC = 7
610 GOTO 660
620 PRINT #2, "CHR(" + MID$(STR$(ASC(A$)), 2) + " ";
630 IF LC >= 7 THEN GOSUB 910 ELSE IF Y <> FL THEN PRINT #2, "+";
640 NEXT
650 PRINT #2,
660 PRINT #2, "SET ALTERNATE OFF"
670 PRINT #2, "SET ALTERNATE TO"
680 PRINT #2, "SET CONSOLE ON"
690 PRINT #2, "RETURN"
700 CLOSE #1, #2
710 PRINT : PRINT "Invalid filename."
720 RESUME 120
800
810 PRINT #2, CHR$(34); PRINT #2, "?? "; CHR$(34);
820 LC = 1: QCNT = 1
830 RETURN
900
910 IF Y = FL THEN RETURN
920 PRINT #2, " "; PRINT #2, "?? "; LC = 0
930 RETURN
```



Figure 1: This program generates a *Clipper* procedure that re-creates a database file.

Databases

THE DATABASE STRUCTURE FOR SAMPLE.DBF

```

Structure for database: sample.dbf
Number of data records: 0
Date of last update: 09/19/90
Field  Field Name  Type  Width  Dec
1  PREFIX  Character  10
2  LAST  Character  50
3  FIRST  Character  50
4  MIDDLE  Character  1
5  SUFFIX  Character  10
6  ADDRESS1  Character  50
7  ADDRESS2  Character  50
8  CITY  Character  50
9  STATE  Character  2
10 ZIP  Character  10
** Total ** 284
  
```

Figure 2: This file was created to generate a sample *Clipper* procedure using MAKECLIP. The procedure is shown in Figure 4.

gether by creating an image of the initial database and including it as part of your *Clipper* source code.

While there's more than one way to create a .DBF file from scratch in *Clipper*, MAKECLIP lets you generate a procedure to re-create any type of file, not just .DBFs.

MAKECLIP generates a procedure that includes a complete copy of the file you

SAMPLE.DBF

```

000000 0 1 2 3 4 5 6 7 8 9 A B C D E F .S.....b.....
000010 03 5A 09 12 00 00 00 00 00 00 00 00 00 00 00 00 PREFIX.c'.c.f.
000020 50 52 45 46 49 50 00 00 00 00 00 00 00 00 00 00 LAST.E.c'.c.f.
000030 0A 00 03 01 F6 21 00 00 00 00 00 00 00 00 00 00 LAST.E.c'.c.f.
000040 4C 41 53 54 08 50 00 00 00 00 00 00 00 00 00 00 2.....R...f.
000050 32 00 03 01 F6 21 00 00 00 00 00 00 00 00 00 00 FIRST.c'.c.f.
000060 46 49 52 53 54 00 00 00 00 00 00 00 00 00 00 FIRST.c'.c.f.
000070 32 00 03 01 F6 21 00 00 00 00 00 00 00 00 00 00 2.....R...f.
000080 4D 49 44 44 4C 45 00 00 00 00 00 00 00 00 00 00 MIDDLE.c'.c.f.
000090 01 00 03 01 F6 21 00 00 00 00 00 00 00 00 00 00 SUPFIX.c'.c.f.
0000A0 53 55 46 46 49 50 00 00 00 00 00 00 00 00 00 00 .....R...f.
0000B0 0A 00 03 01 F6 21 00 00 00 00 00 00 00 00 00 00 ADDRESS1.c'.c.f.
0000C0 41 44 44 52 45 53 53 31 00 00 00 00 00 00 00 00 2.....R...f.
0000D0 32 00 03 01 F6 21 00 00 00 00 00 00 00 00 00 00 ADDRESS2.c'.c.f.
0000E0 41 44 44 52 45 53 53 32 00 00 00 00 00 00 00 00 2.....R...f.
0000F0 32 00 03 01 F6 21 00 00 00 00 00 00 00 00 00 00 CITY.SS2.c'.c.f.
000100 43 49 54 59 00 53 53 32 00 00 00 00 00 00 00 00 2.....R...f.
000110 32 00 03 01 F6 21 00 00 00 00 00 00 00 00 00 00 STATE.S2.c'.c.f.
000120 53 54 41 54 45 00 53 32 00 00 00 00 00 00 00 00 .....R...f.
000130 02 00 03 01 F6 21 00 00 00 00 00 00 00 00 00 00 ZIP.E.S2.c'.c.f.
000140 5A 49 50 00 45 00 53 32 00 00 00 00 00 00 00 00 .....R...f.
000150 0A 00 03 01 F6 21 00 00 00 00 00 00 00 00 00 00 ..
000160 0D 00
  
```

Figure 3: This hex dump shows the complete contents of SAMPLE.DBF.

specify. So if you specify the name of a .DBF, the *Clipper* procedure that's created will contain a complete copy of the .DBF. Basically, MAKECLIP executes in three steps. First, it generates the code at the beginning of the procedure, including the PROCEDURE statement and a SET ALTERNATE TO command for the specified file.

After this, the MAKECLIP program starts at the very beginning of the specified

file and begins to read the entire file a byte at a time, including the file header, if it's a .DBF file. For every byte read, it generates *Clipper* code that will re-create that byte later on when the generated procedure is run.

Finally, MAKECLIP generates the code to complete the procedure including the SET ALTERNATE TO command that closes the named file and the final RETURN statement.

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Databases

mentations process the ?? command differently. However, we'll provide an alternative for *FoxPro* users in a moment.

The *Clipper* ?? command (which is used to re-create the original file) evaluates a MAKECLIP expression and outputs a dBASE expression. When *FoxPro* evaluates the same expression, it automatically searches for line-feed characters and, if it finds any, replaces them with a carriage-return line-feed combination. So if your original .DBF contains any CHR(10) characters, *FoxPro* will add some unwanted line-feeds. Thus, the procedure generated by MAKECLIP won't work, because it will not re-create the .DBF exactly as it was originally.

Along the same lines, when *dBASE IV* evaluates the same expression, it processes it through the assigned printer driver. Therefore, in addition to adding line-feeds, *dBASE* will translate a TAB character into the appropriate number of spaces, strip NUL characters, and translate any characters that aren't printable into some-

thing printable by your printer driver.

Clipper, on the other hand, does not apply any translation to the ?? expression. Therefore, the procedure generated by MAKECLIP can re-create the file exactly as it was originally.

All is not lost for *FoxPro* users, however. In *FoxPro*, you can use the SET PRINTER TO command to direct printer output to a file, and the ??? (that's three question marks) command to send output directly to the printer. In addition, *FoxPro* doesn't perform any translation on an expression following ???. So what's needed

**The Clipper ??
command evaluates a
MAKECLIP expression
and outputs a dBASE
expression.**

is a new version of MAKECLIP that uses SET PRINTER TO instead of SET ALTERNATE TO and uses ??? commands instead of ??. MAKEFOX.BAS does just this. Since this is a relatively easy modification, the code for MAKEFOX isn't printed here. However, its source and executable files, as well as MAKECLIP's, are available for downloading from PC MagNet. Figure 5 shows the code generated by MAKEFOX for our SAMPLE.DBF file. Unfortunately, this technique does not work in *dBASE IV*.

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Research for this article was provided by Salvatore P. Ricciardi, a New York-based consultant and a frequent contributor to *PC Magazine*.

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You need to know the difference between computers that meet the FCC class B radio frequency emissions standards and those that meet only the Class A standards.

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by
Craig Stinson

Spreadsheets

ERROR-TRAPPING IN QUATTRO PRO

To prepare federal and state tax forms, I have created a macro-driven system of *Quattro Pro* worksheets. Because these worksheets require dozens of numeric entries and because inadvertent text entries or blanks could wreak havoc, I decided to equip the system with an error-trapping routine. The one I developed relies on the @ISERR function and the {MESSAGE} macro command. To illustrate the routine, I've included the macro shown in Figure 1.

Each of the {GETNUMBER} commands in B13 through B18 prompts for a numeric value. If anything other than a number is entered, the {GETNUMBER} command returns ERR.

After each entry, control passes to subroutine C, which checks the value of the entry. If C discovers an ERR value, the macro displays the message (M) in a small window. When the user presses any key, the message disappears and the ERR value is erased. Control then shifts to subroutine CC. CC prompts the user to try again. The new entry in turn is tested by subroutine C, and the cycle continues until the user enters a numeric value. At this point control passes back to the main part of the macro.

There may be more-elegant ways to weed out error values, but mine is simple and effective.

Garfield R. Morgan
Lynn, Massachusetts



The combination of @ISERR and {MESSAGE} is indeed a simple and effective way to filter out errant input. In place of this command and function, you might be tempted to use the {ONERROR} command. {ONERROR} lets you respond gracefully to mistakes such as trying to access a nonexistent disk, modify a protected cell, or insert rows in such a way that data would be bumped off the bottom of your worksheet. But {ONERROR} is no help when

■ **ERROR-TRAPPING IN QUATTRO PRO:** Two simple subroutines can help you safeguard against ERR values.

■ **A LIST OF DATES:** If your date intervals are a month or longer, you'll need a formula to accommodate the varying number of days.

text is entered into a cell that's expecting numbers.

Quattro Pro's {MESSAGE} command, which has no equivalent in Lotus spreadsheets, displays text of your choice in a window at a specified screen location. The resulting window looks just like those used by *Quattro Pro* to display error messages and menus.

The syntax for this handy command is

```
{MESSAGE msg_range, horiz_pos,  
vert_pos, time}
```

The first argument, *msg_range*, specifies the worksheet range where you've stored the text of the message. You must be sure to supply the full width and depth of this range. For instance, if you have labels stored in E6..E8, and those labels spill over into columns F and G, you must specify E6..G8; otherwise, your message will be truncated.

The *horiz_pos* and *vert_pos* arguments tell *Quattro Pro* where to display your message window relative to the left and top edges of the screen. The minimum value for each argument is 0; the maximum value depends on the number of rows and columns (character "columns," not worksheet columns) your display accommodates.

To center your message within a full-screen worksheet on an 80-by-25 display that includes a mouse palette, put your entire message in a single column (widen

ERROR TRAP

```
1 A Schedule A - Real Estate B
2 Schedule B - Stocks and Bonds
3 Schedule C - Mortgages, Notes and Cash
4 Schedule D - Insurance on the Decedent's Life
5 Schedule E - Jointly Owned Property
6 Schedule F - Other Miscellaneous Property
7
8 \A /EEG5..G10~{HOME}
9 {GOTO}G5~{GETNUMBER "Enter total from Schedule A. ===>> ",G5}{C}
10 {D}{GETNUMBER "Enter total from Schedule B. ===>> ",G6}{C}
11 {D}{GETNUMBER "Enter total from Schedule C. ===>> ",G7}{C}
12 {D}{GETNUMBER "Enter total from Schedule D. ===>> ",G8}{C}
13 {D}{GETNUMBER "Enter total from Schedule E. ===>> ",G9}{C}
14 {D}{GETNUMBER "Enter total from Schedule F. ===>> ",G10}{C}
15
16
17 C {IF @ISERR(@CELLPOINTER("CONTENTS"))}{MESSAGE M,10,10,0}/EE~{CC}
18 {RETURN}
19
20 CC {GETNUMBER "TRY AGAIN! ",@CELLPOINTER("ADDRESS")}{C}
21
22 M PRESS ANY KEY, THEN RE-ENTER A
23 CORRECT FIGURE. NUMBERS ONLY
```

Figure 1: This 1-2-3 macro illustrates error-trapping subroutines C and CC. C uses the @ISERR function to determine if a label or nothing at all has been entered where the macro expects a numeric value. {MESSAGE} posts an error message, and CC allows the user to make a new entry.

Spreadsheets

the column as necessary), name the range *message*, and use the following expressions for your *horiz_pos* and *vert_pos* arguments:

```
horiz_pos: (78-@cell('width',
, message))/2
```

```
vert_pos: (24-@rows(message))/2
```

The *time* argument can be either 0 or a value calculated with the help of the @NOW and @TIME functions. If this argument is 0, *Quattro Pro* displays your message until the user presses a key. If you specify a time value, the message remains on-screen until the appointed time. To display the message for 10 seconds, for example, you would use the following expression:

```
@NOW+@TIME(0,0,10)
```

Mr. Morgan's macro moves on to subroutine CC regardless of what key the user presses to acknowledge the message. As an alternative to this approach, you can use *Quattro Pro*'s {GRAPHCHAR} command to find out exactly what key is pressed and then modify your macro's behavior accordingly. The user could then

make a nonnumeric entry—impossible in Mr. Morgan's original—or exit the macro gracefully during execution without pressing Ctrl-break.

The {GRAPHCHAR} command, which also has no counterpart in *1-2-3*, has the following simple syntax:

```
{GRAPHCHAR location}
```

In *location* the command records the keystroke a user presses to acknowledge a {MESSAGE} window or to remove a full-screen graph display.

Figure 2 shows a variation of Mr. Mor-

gan's macro that uses {GRAPHCHAR} and {IF} to test for four possible user keystrokes: N, n, Q, and q. If the user presses N or n, the macro uses @NA to insert NA into the current cell and moves on. If the user presses Q or q, the macro erases the ERR value in the current cell and quits.

I have two cautions to pass along about the {MESSAGE} command.

First, pressing F1 to dismiss the message window has unpredictable consequences. Sometimes on my system, I get *Quattro Pro*'s opening Help screen. Other times, the macro simply dies. If I run *Quattro Pro* as a task under *Microsoft Windows*, pressing F1 to remove a {MESSAGE} sometimes invokes the dread *Windows* termination message and forces me to reboot! In any case, the function keys are not recorded by {GRAPHCHAR}.

Second, if you specify a short time interval for the display of your message, you'll rarely get the duration you ask for. If you want your message to appear for 3 seconds, it may remain on-screen anywhere from about 2.5 seconds to nearly 5. This inconsistency is not the result of a bug, but rather of *Quattro Pro*'s (and, incidentally, *1-2-3*'s) inability to track time at that fine a level of detail. (The {WAIT} command—in both *Quattro Pro* and *1-2-3*—is subject to the same limitation.) Note that the higher the specified time value, the more nearly you'll get what you request.

A LIST OF DATES

Lotus 1-2-3, *Symphony*, and *Quattro Pro* make it easy to list a series of consecutive

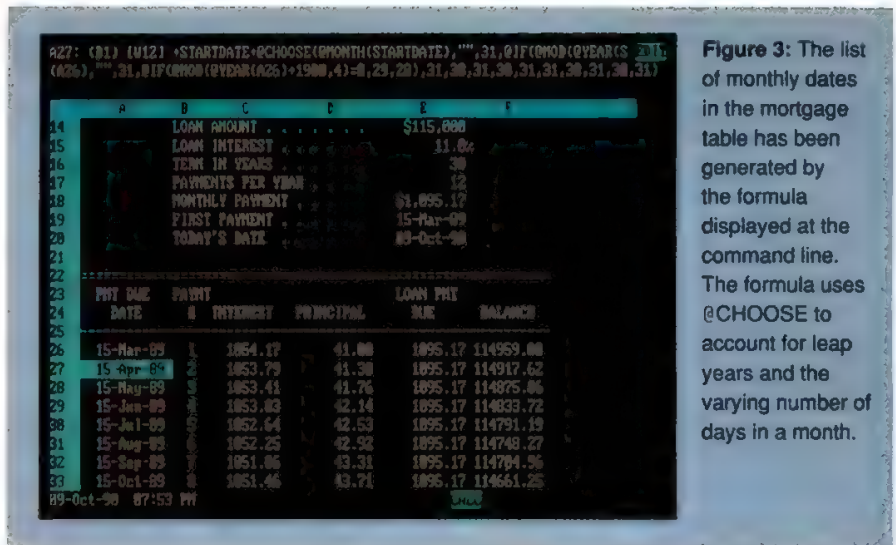


Figure 3: The list of monthly dates in the mortgage table has been generated by the formula displayed at the command line. The formula uses @CHOOSE to account for leap years and the varying number of days in a month.

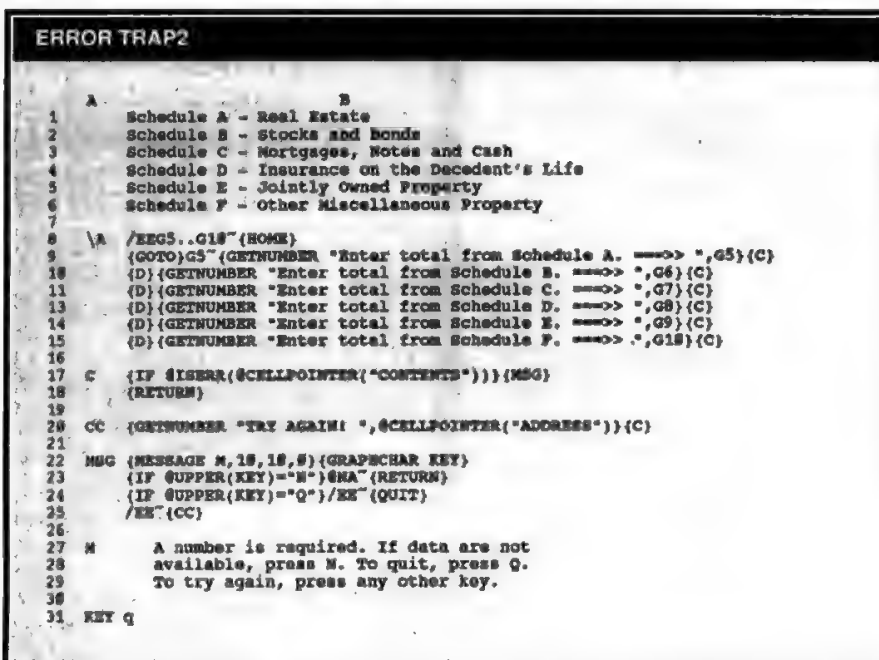


Figure 2: This modification of Figure 1's macro uses the {GRAPHCHAR} command to let a user place NA in the input cell or quit the macro altogether.

Spreadsheets

days or weeks. You would simply select /Data Fill and specify 1 (for the days) or 7 (for the weeks) as your *step* value. But what if you want to fill a range with the first day of each month? Or the fifteenth, or some other common date in each month? For these intervals, you can't use /Data Fill. The number of days varies from month to month, so if your interval is one or more months, the step value would vary as well. Leap years further complicate the task.

To compile a list with the first day of each month, I developed the following formula:

```
+STARTDATE+@CHOOSE (@MONTH  
(STARTDATE), ' ', 31, @IF (@MOD (@YEAR  
(STARTDATE)+1900, 4)=0, 29, 28), 31,  
30, 31, 30, 31, 31, 30, 31, 30, 31)
```

STARTDATE is the name of a cell containing the first date in the series; it functions as the point of reference from which all other dates are determined. If your first date is to be February 1, 1990, STARTDATE should contain the formula @DATE (90,2,1). To generate your list, enter the monster formula above into the cell directly below STARTDATE. Then copy the formula down over as many rows as necessary.

I find this formula particularly useful for creating mortgage tables (such as the one shown in Figure 3).

Howard Smallowitz

Austin, Texas



Mr. Smallowitz's formula neatly solves a commonplace problem. The formula pivots on the @CHOOSE function, which uses the syntax

```
@CHOOSE (offset, list)
```

The value returned is the *offset* member of the *list*. In Mr. Smallowitz's version, the *offset* value will be the number of the month; the *list* reflects the various number of days in each month.

The @CHOOSE arguments are rather straightforward except that they include a dummy term (the pair of quotation marks just before the first 31 in the formula) as well as an embedded @IF function.

The dummy term is required because

@CHOOSE's insistence on counting from 0 instead of from 1. To return the first value in *list*, *offset* must be 0; to return the second value, *offset* must be 1—and so on. Mr. Smallowitz's *offset* argument, @MONTH(STARTDATE), can never fall outside the range of 1 to 12, so it

If you want to list
dates that span many
months, /Data Fill
won't work. Instead,
try a simple formula
that uses the 1-2-3
@CHOOSE function.

doesn't matter what the first value in *list* is. There is no way that it will ever be selected, but he has to have something in that position anyway. A dummy text value ('') will do just fine.

The embedded @IF function in the February position takes care of the leap-year issue. On years that are divisible by 4, the function returns 29; otherwise it returns 28.

If you're using this formula to set up an amortization schedule, you might want to convert all the date formulas to numeric constants after you get the schedule set up. You can do this by putting your cell pointer at the top of the date list, typing /Range Value, specifying the entire list as your FROM range, then specifying the first cell in the list as your TO range. Without the burden of recalculating each date formula, 1-2-3 will take only about half as long to update the schedule in response to a change in one of the loan parameters.

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by
Neil J. Rubenking

User-to-User

GLOBAL PROCESSING

I'd like to thank you and your readers for giving me many useful ideas. Sometimes I've been able to combine a couple of the ideas to solve a problem. I hope to repay some of the debt I owe with this letter.

One of the users in our company reported that his hard disk was full. When we looked into the situation we found that the disk was indeed full, but a massive area was taken up by .BAK files. By deleting these, we restored more than enough room on the hard disk.

Since then, we've tried to control the growth of .BAK files. Initially, this meant laboriously going through the different directories deleting any .BAK files we found. Fortunately, several issues back, you introduced the idea of using ATTRIB to search through subdirectories for files, and we were able to automate the process, at least to the extent of creating a list of the relevant files.

Of course, once we had the list, we still had to delete the files. This meant going through the list, moving through affected directories and deleting—still a tedious process. Then another issue introduced the use of EDLIN script files, and our problem was solved.

I created two files to handle the task. The first, DELBAK.BAT (Figure 1), uses the ATTRIB function to send a list of .BAK files on the current disk to a file called FIL.BAT. (This works only with DOS 3.3 and later.) Each line of the latter file then contains the name of a .BAK file preceded by the letter A

■ **GLOBAL PROCESSING:**
Add EDLIN to ATTRIB
and you get a tool for
processing matching
files anywhere on your
disk.

■ **RECORD YOUR STATUS:**
Get a listing of system
status for your own
records or for calling tech
support.

and a few spaces, unless the file has been backed up or any of the other attributes of the .BAK file have been changed. I added the two spaces after the A to make sure EDLIN changes only the first A in the line and no other.

GLOBAL.BAT COMPLETE LISTING

```
@ECHO OFF
IF '%1'=='' GOTO noparam
ATTRIB +A %1/S
ECHO @ECHO OFF > TEMP.BAT
ATTRIB %1 /S>TEMP.BAT
EDLIN TEMP.BAT < EDLIN2.SCR > NUL
CALL TEMP.BAT
DEL TEMP.BAT
GOTO end
:noparam
ECHO SYNTAX: "GLOBAL filespec" (wildcards ok)
ECHO The batch file "A.BAT" will be called once
ECHO for each file matching the filespec.
:cmd
```

Figure 2: This batch file is a generalized version of DELBAK—it runs A.BAT on all matching files.

The second file is EDLIN.SCR, as follows:

```
1RA ^sdel
E
```

DELBAK.BAT uses this script to change the A (plus two spaces) to del. Next it runs FIL.BAT, which deletes all of the .BAK files but its own (created by EDLIN). Finally, it deletes FIL.BAT and the associated .BAK file. If there are no .BAK files on a particular drive, the message "Invalid Path or File Not

Found" appears on the screen.

As noted in the column on EDLIN script files, the Ctrl-Z in EDLIN.SCR will be read as the end of the file if you try to edit the file. The only way you can make changes to it is to delete and start again. However, it carries out its function very well.

Christopher Ward
Sommerville Park, Singapore



Actually, EDLIN *can* edit a file that contains Ctrl-Z end-of-file characters. You just have to attach the /B switch to the filename on the EDLIN command line, for example

EDLIN FOO.BAT/B

Note also that PC Magazine's SWEEP .COM utility will execute any command in all of your directories. If you enter

SWEEP DEL *.BAK

from the root directory, you'll rid a disk of .BAK files.

The global technique processes only those files whose Archive bit is set. Most backup programs clear the Archive bit, so files that haven't been changed since the last backup won't get processed. To ensure that you don't miss any files, simply set the Archive bit ON for all the files you want to work with. In Mr. Ward's example, the command

ATTRIB +A *.BAK /S

would take care of it.

If the operation you want to perform on each file won't fit on one line, there's a simple solution. Use an EDLIN script that replaces each A (plus two spaces) with the command CALL A (space), as follows:

```
1RA ^ECALL A
E
```

Create a batch file called A.BAT that takes one parameter—a filename. Insert all the

DELBAK.BAT COMPLETE LISTING

```
@ECHO OFF
CD\
ATTRIB +A *.BAK/S
ATTRIB *.BAK /S>FIL.BAT
EDLIN FIL.BAT < EDLIN.SCR > NUL
CALL FIL.BAT
DEL FIL.BAT
```

Figure 1: This batch file looks at all directories to create a list of files matching a template and then uses the list to delete those files.

User-to-User

commands you wish to inflict on each file. For safety's sake, test whether the first parameter is a lone R—which indicates that the file is Read-Only. Either skip it, print a warning, or (if Read-Only status doesn't matter) use the *second* parameter.

Figure 2 is GLOBAL.BAT and Figure 3 is a sample A.BAT. Using the ATTRIB technique, GLOBAL builds a temporary batch file with one line for each file on the disk that matches the template you give it. When run, the temporary batch file calls A.BAT once for each matching file. The nice thing about this is that you never have to change the EDLIN script. If you want a new action, just change A.BAT.

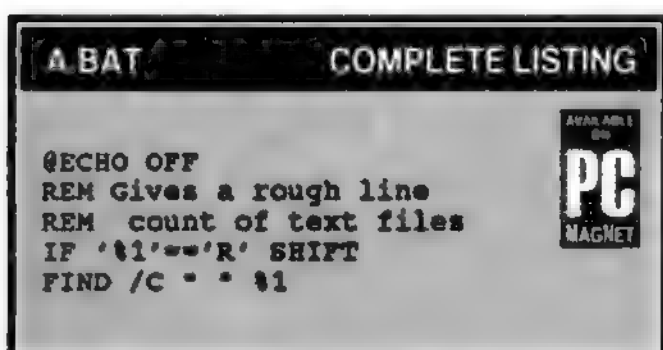


Figure 3: This sample batch file will operate on every file that matches the template passed to GLOBAL. In this example, A.BAT just gives a rough line count for each file.

RECORD YOUR STATUS

When I change hardware or software, it often requires changes to my AUTOEXEC.BAT, CONFIG.SYS, or environment. Sometimes a problem occurs later (never immediately enough to be obvious) because of the changes I made in those areas. So I've come up with the batch routine STATUS.BAT (Figure 4) to document these areas. Then if a problem does occur,

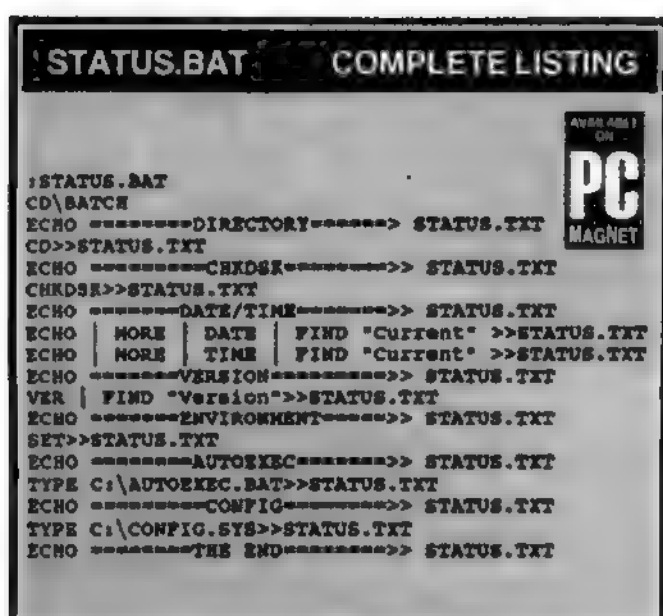


Figure 4: This handy batch file records your current configuration in STATUS.TXT.



Figure 5: Here's an example of the output produced by STATUS.BAT.

I can always look back at my previous configuration and work from that known starting point.

It's also useful to have this information handy if you need to troubleshoot problems over the phone, because the tech support people on the other end will want to know these details.

I keep STATUS.BAT in my BATCH directory along with all my other batch files. Each line either ECHOes a heading or reports information, redirecting all output into a file called STATUS.TXT. Figure 5 shows an example of this file.

John L. Corbitt
Boca Raton, Florida



PC STATUS.BAT writes over any existing STATUS.TXT file, so if you want to save previous versions, you'll have to rename them. It can be *very* handy to have a complete record of all the changes you've made to your system. You might even want to add notes at the end of each STATUS.TXT file. You

can either add them with your favorite editor or append a couple of lines to STATUS.BAT itself, as follows:

```
ECHO Enter notes. Press
ECHO Ctrl-Z when done.
COPY STATUS.TXT+CON > NUL
```

Now when you talk to the Technical Support department of a hardware or software company, you'll have most of the information they want at your fingertips. Read it to them over the phone, send the file as electronic mail, or even fax it to them.

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by
Jeff Prorise

Tutor

COMPUTER IMAGING

Why do images on color television sets, which have relatively low screen resolutions (768-by-486 to -525) appear to be so much sharper than those on CRT screens, which have resolutions of 640 by 480 and even 1,024 by 768 pixels? Could you also explain why high-resolution video adapters are so expensive?

Marcio Abreu
São Paulo, Brazil



It's not just *resolution* that determines the sharpness of the picture; it's the number of colors. Nature supports an almost infinite range of colors that your analog television set does a pretty good job of duplicating. Most video adapters, by contrast, support only a narrow range of colors, limited by the amount of video RAM on board and by the architecture of the adapters themselves. A stock VGA, for example, supports only 16 colors in 640-by-480 graphics mode. That's good enough to draw a line across the screen in a CAD draw-

■ **COMPUTER IMAGING:**
The resolution of your video adapter isn't the only thing that determines how sharp your images will be.

ing but it's not good enough to simulate the look and feel of nature's canvas.

Images on television sets also appear sharper because the analog nature of TVs allows them to make the transition from one color or brightness level to another smoothly, producing an effect similar to *antialiasing* on a computer screen. Antialiasing is the process of smoothing out the rough edges in raster images by adjusting the brightness level of individual pixels in order to produce the illusion of continuity. On a television set, a detail that is too fine for the resolution of the screen doesn't drop out of the picture

altogether; instead, color in the area in and around it is adjusted to give the impression that the detail is there. Significantly, the eye perceives its presence. On an aliased computer screen, the detail simply doesn't appear at all.

It also helps that the approximately 500 scan lines that NTSC TV screens are divided into vertically are slightly overlapped, blurring the separation between them. (NTSC, an acronym for National Television Standards Committee, is the broadcast standard used in the United States.)

The human brain is adept at interpreting blurry images, so the TV screen appears to have a higher resolution than it really does. The stair steps in pixel-based images, on the other hand, give the monitor a harsh look and make images appear crude and artificial.

The two pictures in Figure 1 show the effect a wider selection of colors has on images displayed on the computer screen. The image on the left is shown on a VGA display in 16-color 640-by-480 graphics mode. Note how the limited palette of

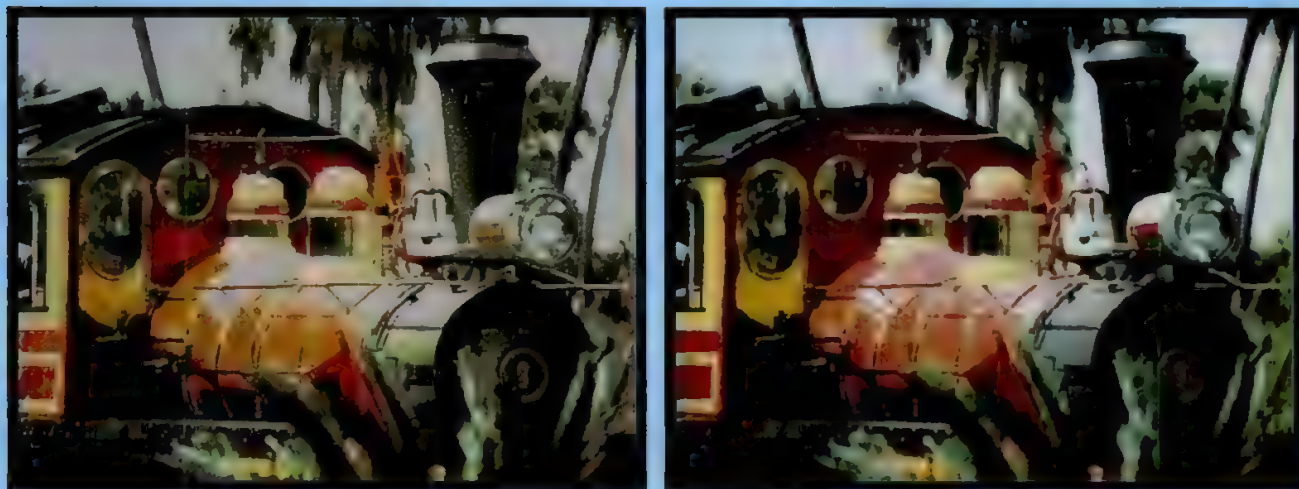


Figure 1: Two identical images of a steam engine, one rendered on a 16-color 640-by-480 VGA (left) and the other on a 256-color 320-by-200 VGA (right). The limited palette of colors used in the image on the left makes the picture appear rough and grainy, while the wider range of colors in the image on the right lends a more photorealistic air.

Tutor

colors makes the picture appear rough and grainy, despite the resolution. On the right, the same image on the same VGA is shown in 256-color 320-by-200 graphics mode. Thanks to the extra colors, the look is dramatically improved, to the point that the quality of the image rivals that of a photograph.

It's possible to increase the effective number of colors in an image using a technique known as *dithering*. Dithering combines pixels of different colors to produce colors that lie in between. An area might be colored blue-green, for example, by alternating blue and green pixels vertically and horizontally. (There doesn't have to be an even mix. An area might have 1 blue for every 8 green pixels.) Dithered images are grainier than non-dithered images, but often the trade-off of resolution for colors is worth it, especially when flat-coloring the image results in the loss of contrast between adjacent, similarly shaded areas. Figure 2 shows a dithered version of the 16-color image in Figure 1. Note the improved appearance and the illusion that there are more than 16 colors in the scene.

The rage in PC graphics these days is 24-bit color, which assigns 8 bits (256 different intensities) to each of the three primary colors—red, green, and blue—for a color palette of over 16 million colors. Most experts agree that 24-bit color is rich enough to allow accurate portrayal of lifelike images to the human eye. Boards that support millions of colors are avail-

able for the PC from manufacturers like Truevision, which recently replaced its popular Targa line of video adapters with the newer Targa+ 16/32. The Targa+ can be configured for 16-, 24-, and 32-bit operation. (Some believe that there's no need for more than 24-bit color since the human eye can't actually perceive the difference between two adjacent 24-bit colors. See the Environments column in this issue for a more in-depth discussion of this point.)

**The rage in PC
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Why are high-resolution, high-color boards so expensive? Because of the hardware it takes to drive them. The amount of video RAM needed to support 24-bit color on a 1,024-by-768 screen exceeds 2MB, and 2MB of fast video memory

doesn't come cheap. Video RAM, also known as VRAM, differs from conventional DRAM in that it can be addressed linearly rather than in rows and columns and in that it is dual-ported, meaning two sources—the CPU and the video refresh circuitry—can access it simultaneously. In the final analysis, you can easily spend more on 24-bit display hardware than you do on the rest of your system. The Targa+ 16/32, for example, sells for \$1,995 with 1MB of RAM, and that doesn't include the monitor to go with it!

But the good news is that prices are beginning to come down. The adapter the Targa+ 16/32 replaced retailed for \$4,995 just six months ago. The reduction in price stemmed from the consolidation of costly hardware logic into Application-Specific Integrated Circuits (ASICs) and the availability of denser VRAMs, yielding decreased silicon costs and lower overall manufacturing costs.

One valuable resource for exploring the world of computer imaging is CompuServe's Graphics Net. The Graphics Net comprises five forums dedicated to the support of computer graphics and the exchange of graphics-related information. To get there, simply type GO GRAPHICS at the CIS prompt. In Graphics Net you'll find libraries of picture files stored in .GIF (Graphics Interchange File) format, which you're free to download for private, noncommercial use. For viewing, you should download a copy of John Bridge's excellent PICEM.EXE utility, a public-domain file viewer that supports .PIC, .PCX, and .GIF file formats on a wide range of video adapters.

I would like to thank Valerie Zen, a frequent visitor to the Graphics Net and owner of Columbus, Ohio-based Zen Graphics, who scanned these images for me and lent her expertise and advice in too many ways to count. The images in this column were scanned from photographs on a Sharp JX-450 color flatbed scanner, converted to .GIF format with *Piclab*, and framed in *Colorix*.

ASK THE TUTOR

The Tutor solves practical problems and explains techniques for using your hardware and software more productively. To have your questions answered, write to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see page 8 for access instructions). We regret that we are unable to answer questions individually. ■



Figure 2: The same 16-color 640-by-480 image shown in Figure 1, but this time with dithering to increase the perceived number of colors. Note the marked improvement over the undithered 16-color image.



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V.32 Smorgasbord



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CIRCLE 367 ON READER SERVICE CARD

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by
Frank J. Derfler, Jr.

Connectivity

PRINT WHEN YOU'RE READY

Our office has an AT&T StarLAN network. When we print from our DOS applications, the print job goes to the server, but it isn't printed until we exit from the program. Our technical support department tells us that StarLAN does not immediately send a job to the printer, but it waits for more output. Is there any way to let StarLAN know the print job is finished?

Annette B. Gates
Richmond, Virginia



Yes, there is a way. Simply hit the Ctrl-Alt-PrtScr key combination after the application sends the print job to the print server. The application program will pass this combination to the network print server and will consequently close the print queue.

REMOTE MOUSE SUPPORT

Our network technical staff wants to use what you've called a LAN remote-control software package to help people run their applications, but a growing number of people in our office use a mouse with *Microsoft Windows*. We haven't found a LAN remote-control product with mouse support. Can you help?

Beverly Close
Norwood, Massachusetts



LAN remote-control software packages allow one networked PC to attach to the screen and keyboard of one or more PCs on the network. Many organizations find these products useful for technical support and for classroom instruction.

If you want to experience the advantages of *Windows* and remote mouse support, give a call to Avalan Technology at (800) 441-2281. This company sells a program called *Remotely Possible*, which moves *Windows* screens and mouse commands across *NetWare* LANs. An eight-user version will cost you \$299.

One word of warning: Although *Re-*

- **PRINT WHEN YOU'RE READY:** Here's a simple way to let a StarLAN network know you're ready to print.
- **REMOTE MOUSE SUPPORT:** A remote-control program that provides mouse support on a LAN.
- **LINKING DISSIMILAR WIRING SCHEMES:** There are at least three good ways to connect twisted-pair and thin coaxial systems.
- **SHARING A LASERJET:** Here's a handy product that fits inside your printer and handles print jobs from as many as ten simultaneous users.
- **WHAT SORT OF SERVER:** Most organizations don't really need superservers.
- **SAVING LOCAL PATHS:** Yet another way to avoid overwriting local paths in *NetWare*.

motely Possible is written cleverly enough that it sends only changed screen pixels across the network, a lot of pixels change every time you select a *Windows* icon. This large volume of data can slow down other network processes, so it's a good idea to do some experimenting before you run too many simultaneous remote-control *Windows* sessions on a busy production network.

LINKING DISSIMILAR WIRING SCHEMES

We have a large Ethernet network cabled with thin coax. Another department is installing a 10BaseT network using unshielded twisted-pair wiring. That department claims it will never need to connect to the larger network, but I bet it will. I want to be prepared when the question comes up, so please tell me the best way to link the thin Ethernet to the twisted-pair.

Tony Johnson
Aurora, Colorado



There are at least three good ways to link twisted-pair with thin coaxial systems. First, you can specify 10BaseT wiring centers with an AUI adapter and attach a thin Ethernet transceiver to the AUI port. Second, you can specify a Synoptics wiring center with the ability to terminate and manage both thin coax and twisted-pair cabling in the same box. Finally, you can call LANcast (603-880-1833) and ask about its Transcast Universal Twisted-Pair/Coax Translator. This little box (it's smaller than a modem) can serve as a bridge between two coaxial LAN segments, two twisted-pair LAN segments, or translate between coaxial and twisted-pair wiring. At \$295, Transcast is an inexpensive and flexible solution for extending and linking coaxial cable and twisted-pair wiring schemes.

SHARING A LASERJET

We don't have a local area network and don't think we'll need one anytime soon. But we do want to share a LaserJet among four people. What's the easiest way to let four PCs share a LaserJet without installing a network?

Jim Schwartz
New York, New York



There are several good ways to share a single printer without installing a full media-shared network. My favorite solution for sharing LaserJets is the SimpLAN ServerJet, which

Connectivity

is sold by ASP Computer Products. This product fits inside a LaserJet II, IID, or III printer and is capable of handling print jobs from as many as ten simultaneous users. Each user's PC is connected to the ServerJet-equipped LaserJet with thin telephone-type cable.

Because the ServerJet looks like a standard LaserJet to the connected computers, the users don't need to do anything special to send out their print jobs. Any computer that is compatible with a LaserJet—including a Macintosh or a minicomputer—can also take advantage of the ServerJet.

The ServerJet model ST622 can connect six computers to the LaserJet and provides a second connection to another parallel printer. It sells for \$695. Users who are running DOS can use a pop-up menu to select the printers. The lowest-priced, ST621 ServerJet connects six computers to a LaserJet and costs \$495. The ServerJet is the smoothest and most practical way I know to share a LaserJet. If you would like more information about these products, call ASP Computer Products at (408) 746-2965.

WHAT SORT OF SERVER

I'm a regular reader of your column, though my company hasn't installed its first network yet. We are strongly considering it though, and consequently I've got a lot of questions. For starters, do I need some kind of special computer to act as a server on a Novell *Advanced NetWare 286* network? Do I need to have more than one server on the network? Could you also explain what servers have that other PCs don't?

Bob Elgar
Madison, Wisconsin



Several companies market a class of computers designed to act as file servers. These machines typically have room for several hard disk drives and ports to connect five or more printers and plotters. The newest feature of such specialized servers is the ability to provide multiple CPUs to the network operating system. These multiprocessor computers usually carry a significantly higher price tag than machines with slightly more humble, but still very substantial, capabilities.

The fact of the matter is that very few organizations have the need for such superservers today. A properly configured computer with an 80386 processor operating at 25 or 33 megahertz can act as a file and print server under *NetWare*, *LAN Manager*, *VINES*, or *Unix* for 100 to 200 client PCs running typical office applications. In this case, proper configuration means a fast hard disk drive, a disk drive controller capable of caching requests, and an adequate number of network interface adapters installed in the server to carry the load.

Multiprocessor capabilities become important when you need to add more applications to the server. Database server software and communications server software reduce CPU efficiency because of all the interrupts these programs generate.

Modern networking
software products
make it far easier than it
used to be to manage
separate servers,
and the advantages
of reliability and
scalability—inherent in
a modular approach—
are indeed significant.

If you need to run these kinds of server programs, you have two alternatives to choose from. You can establish a separate server on its own PC for each type of program, or you can combine them all into a single server with multiple processors. You should note that using separate PCs has some significant advantages in terms of system reliability and performance.

On the whole, I recommend that you build your network in a modular fashion. It makes sense to set up separate computers to act as communications, database, and file servers to create the capacity and throughput you need where and when

you need it. Think carefully before you put all of your processing power into one cabinet.

Purists may argue against separate servers because they mean larger amounts of data must move over the LAN cabling, but this is nothing more than a minor consideration. If the load on a particular cable segment becomes too heavy, routers provide a good means of keeping traffic localized.

Modern networking software products make it far easier than it used to be to manage separate servers, and the advantages of reliability and scalability—inherent in a modular approach—are indeed significant.

SAVING LOCAL PATHS

In the July 1990 issue of *PC Magazine*, Michael LeBlanc wondered how to MAP workstation drives without trashing the local path in a Novell *NetWare* environment.

The definitive answer is to use MAP INSERT in the System and Personal Login scripts when adding Search Drives. This allows the search drives to be appended to the front of the existing path at the time of login, and the original PATH will then be restored when the user logs off the network. But keep in mind that you are still limited to 16 search drives, including the local references.

I use this method exclusively on the 200-plus node Novell network I manage. It works great!

Scott Hansen
Renton, Washington



Using the MAP INSERT command in the login scripts is certainly the textbook solution to this problem. Luckily, Novell's SYSCON utility makes it easy to copy personal login scripts among different users on the network, so you can easily put MAP INSERT in everyone's script.

NETWORK YOUR QUESTIONS

Connectivity gives you practical solutions to networking problems of all types. We'll pay \$50 for any tips we print. Please submit your letter on a disk along with a printout. Then mail your contributions to Connectivity, *PC Magazine*, One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named PC MAGAZINE LAN LABS). We're sorry, but we are unable to answer letters individually. ■

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- ✓ 14" Super VGA color monitor, 1024x768 resolution, with 16 bit VGA card with 512K.
- ✓ Clock calendar, parallel port, and two serial ports. (Game port included on color systems)
- ✓ Keytronics 101 key keyboard.
- ✓ 8 expansion slots, 5 available.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ Windows & Mouse add \$99.
- ✓ Compatible with DOS, OS/2, Windows, Xenix and Novell.
- ✓ FCC Class B approved.

System Price	65mb	80mb	100mb	200mb
Monochrome	\$1,699	\$1,829	\$1,899	\$2,299
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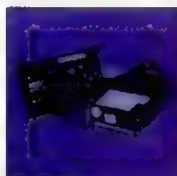
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Intel	
8087-2	115
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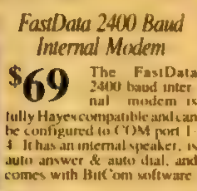
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Promodem 1200B Internal	48
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Courier HST 14,400 Int.	539
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Curtis	
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Ruby Plus	59
Datashield	
CPS-80 - 6 outlet surge	19
S-85 - 6 outlet surge EMI/RFI protection	49
S-100 - adds modem protection	57

FastData Products

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FastData CGA Card	35
FastData MGP Card	35



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Mitsubishi 60mb AT Kit

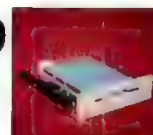
\$349

RLL encoding, 1:1 controller, and 22ms access time make this a quick performer. The perfect upgrade for your 286 or 386 compatible. This kit comes with everything you need including controller and cables.

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Complete with mounting brackets and installation instructions, this Toshiba works in all true 286 & 386 compatibles. Will also read/write/format 720K 3.5" disks. Rails, add \$5.



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WE1007V-SE2 ESDI AT 1:1 Controller	149

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System Price	40mb	65mb	80mb	100mb
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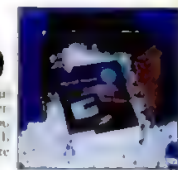
Word Perfect 5.1	239
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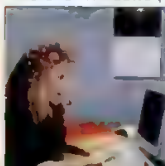
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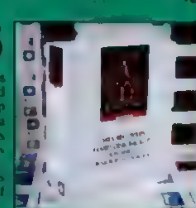


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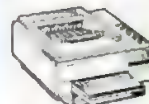
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MAGAZINE

EDITORS' CHOICE

June 27, 1989

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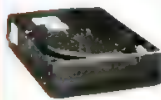


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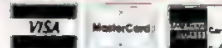
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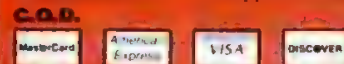
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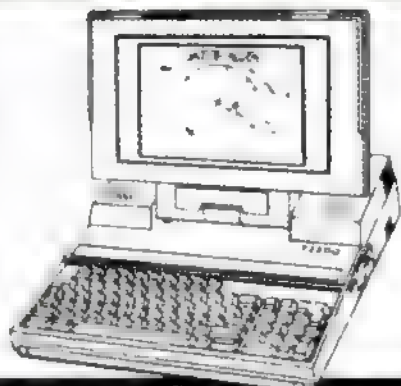
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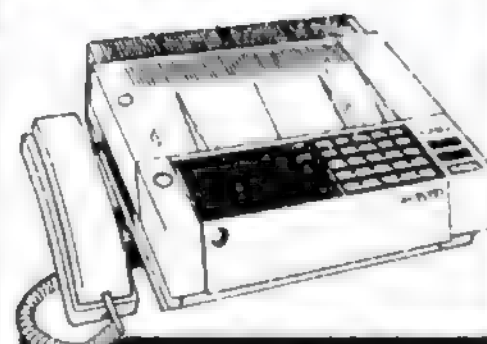
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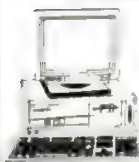


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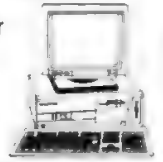
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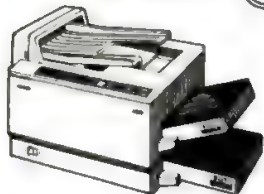
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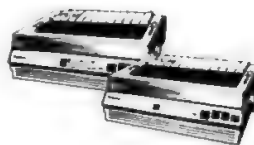
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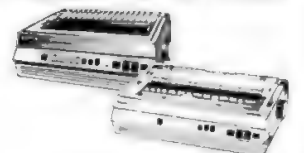
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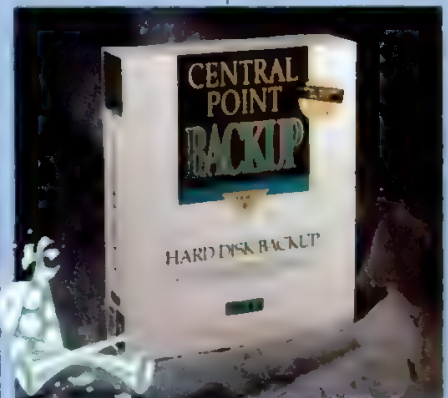
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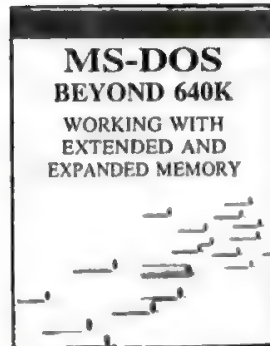
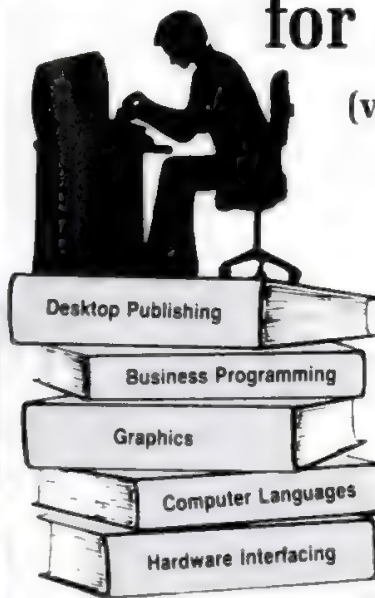
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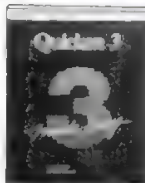
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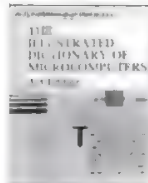
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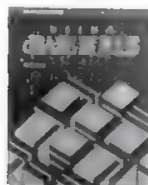
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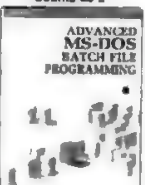
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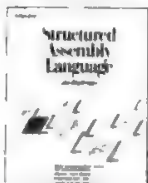
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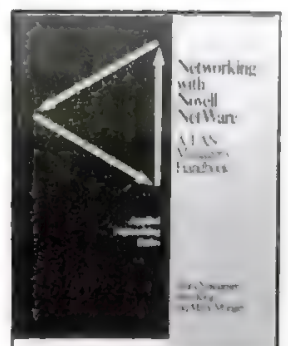
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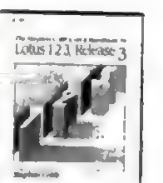
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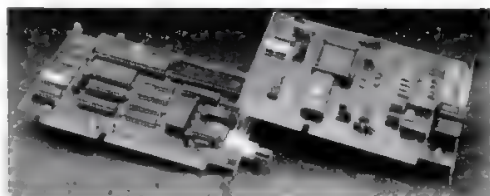
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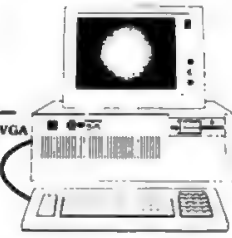
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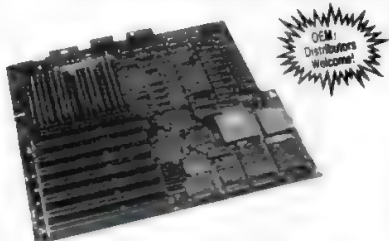
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Source: Beta Research Study, 1988

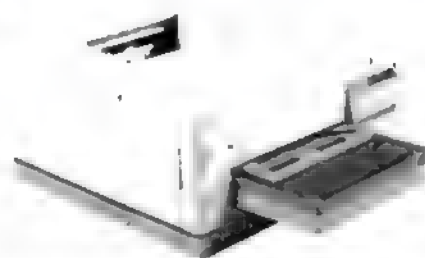
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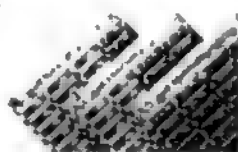
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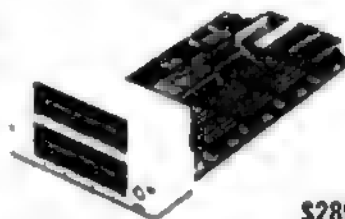
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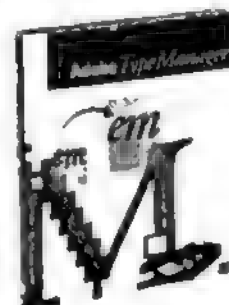
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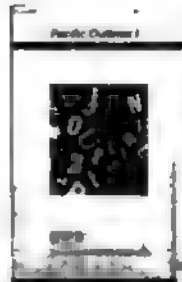
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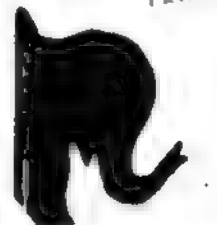
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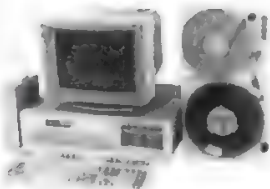
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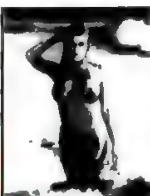
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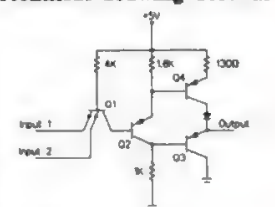


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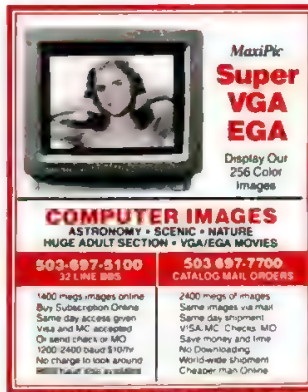
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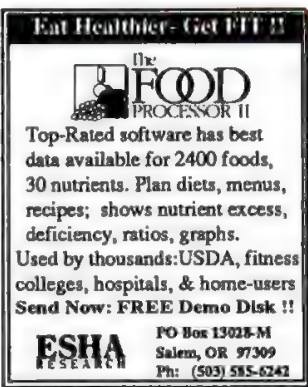
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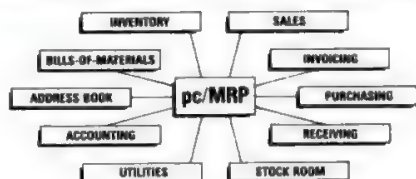
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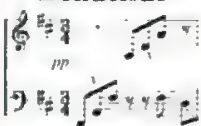
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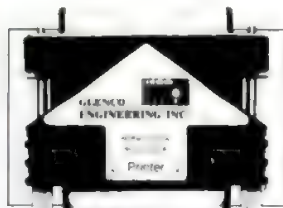
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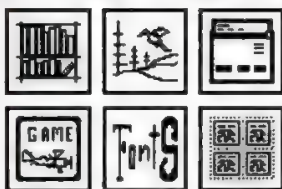
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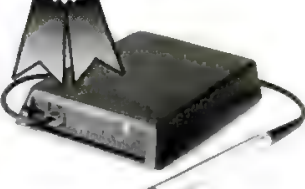
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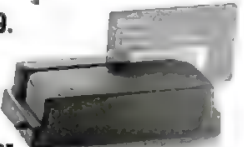
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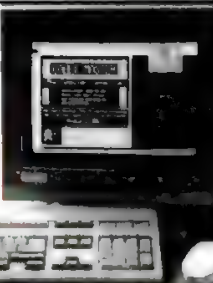
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PC MAGAZINE ADVERTISING SALES STAFF

One Park Avenue, New York, N.Y. 10016
(212) 503-5100

Director of Sales - Telemarketing - Nancy Newman
Telemarketing Manager - MaryJo Boudinot

Senior Advertising Coordinator - Allyson Dubin
Advertising Coordinator - Christine Holsten
Asst. Advertising Coordinator - Lynette Stiffa

AI DI Guido - Eastern Advertising Manager (212) 503-5310

MA, NH, VT, ME, RI
Sloan Seymour - District Manager
(617) 497-2632
4 Cambridge Center
Kendall Square
Cambridge, MA 02141
Todd Anderman - Account Representative
(212) 503-5132

CT, NY, NJ, PA
Michael Bird - District Sales Representative
(212) 503-5307
Lisa Friedman - District Sales Representative
(212) 503-5149
Peter C. Weedfald - District Manager
(212) 503-5269
One Park Avenue
New York, NY 10016
Joyce Wasserman - Account Representative
(212) 503-5333
Stephanie Brzozowski - Account Representative
(212) 503-5675

**DE, MD, DC, VA, WV, NC, SC, AL, MS, TN,
AR, KY, GA, FL**
Scott J. Seltz - District Manager
Mark Crafts - District Sales Representative
3405 Piedmont Road
Atlanta, GA 30305
(404) 239-9780
John Despirito - Account Representative
(212) 503-5130

Robert Diftler - Central Advertising Manager (312) 346-7666

**NE, WI, IL, IN, KS, MN, MO, OH, MI, IA, ND,
SD, Canada**
Stephen Dress - District Manager
Jay Overbye - District Sales Representative
150 North Wacker Drive
25th floor
Chicago, IL 60606
(312) 346-7666
Maureen Dooley - Account Representative
(212) 503-5126
Chris Sullivan - Account Representative
(212) 503-5047

TX, OK, LA, UT
Sandy Schackman - District Manager
5956 Sherry Lane Suite 625
Dallas, TX 75225
(214) 691-6934
Karen Keavey - Account Representative
(212) 503-5104

Pamela Rock - Western Advertising Manager (415) 378-5525

CA (San Francisco & North), ID, OR, WA
Mike Kisseberth - District Manager
(415) 378-5527
Rick Vandervoorn - District Sales Representative
110 Marsh Drive, Suite 103
Foster City, CA 94404
(415) 378-5520
Deborah Gatton - Account Representative
(212) 503-5129

**CA (Santa Barbara to So. San Francisco),
WY, MT, AK, CO, UT**
Pete Foster - District Manager
Kim Dawson - District Manager
110 Marsh Drive, Suite 103
Foster City, CA 94404
(415) 378-5528

CA (San Diego & Orange County), AZ, NV, HI
Robin Kofsky - District Sales Representative
David Lynn - District Sales Representative
18500 Von Karman Ave. Suite 510
Irvine, Ca. 92715
(714) 852-8001
Michael Hatherill - Account Representative
(212) 503-5113

CA (Los Angeles)
Mary Ariotto - District Manager
Paul Klein - District Sales Representative
3530 Wilshire Blvd.
Suite 645
Los Angeles, CA 90010
(213) 387-2100
Beth Gartenberg - Sr. Account Representative
(212) 503-5040



COMING UP

■ DBASE IV: A NEW BEGINNING?

dBASE IV, Version 1.1, is finally on the market. See if it has the features to take on competitors that have leapt ahead in the past two years.

■ ENVELOPE PRINTERS

PC Labs tests three specialized workhorses from DataTech, Primages, and Rena. Tailored for envelope printing, these viable alternatives to conventional printers are enhanced by POSTNET bar code capabilities.

■ LAN BACKUP SOFTWARE

Network managers need ways to back up their servers to other servers or to removable media drives or even portable PCs. PC LAN Labs investigates four programs that provide these options.

■ LAN MEMORY MANAGEMENT SOFTWARE

Network administrators face resistance from users who lose RAM to networking software. These six software packages enable loading of network software into RAM above the 640K used by DOS applications.

■ POWER DIRECTORS

Today's power directors offer such features as surge suppression and electrical noise filtration. *PC Magazine* evaluates 16 power directors that combine convenience and protection for \$70 to \$200.

■ SMALL-FOOTPRINT FCC CLASS B 386/25 PCS

These 14 systems cram 25-MHz 386 processor power into a small case. You can take these machines home, too, as all come with FCC Class B certification.

■ VECTOR FILE CONVERSION SOFTWARE

Vector graphics images are more easily scaled and edited than bitmapped images. But there's still no noted standard file format for such images. We look at four conversion packages that handle such vector formats as .CGM, .WMF, and .EPS. ■

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				Connectivity				Avoid overwriting local paths in NetWare.			

After Hours

Products for the Leisure Side of Personal Computing

Bringing It All Home: Five New PCs Your Family Can Live, Work, And Play With

HOME PCs
by Mitt Jones

Most *PC Magazine* readers, computer-savvy as they are, would rather have a computer at home than a "home computer." But there is a potentially vast audience of nonbusiness users who could benefit from having a computer in the family room or on the kitchen counter. The problem is coming up with a system that is powerful enough to be useful and simple enough to be *usable* by mom, dad, and kids.

In the following pages, we take a close look at five systems geared for home use, rather than simply for the person who needs to work at home. The many differences among these computers—both in general conception and in features included—suggest that there is not yet a firm definition of exactly what a home computer is.

At the low end is the Tandy 1000 RL, introduced about one month after IBM's home-minded PS/1. The 1000 RL retails at \$599 in its base configuration and depends on the humble 8086 processor for its smarts. At the high end is the Magnavox HeadStart 500 CD, which goes even beyond the 10-MHz, 80286 performance of the IBM PS/1. The HeadStart offers a 16-MHz 80386SX processor, a CD-ROM drive, and a tantalizing collection of CD-based software, all for a list price of \$2,999.

The disparities among these machines extend beyond pricing and processor, particularly when it comes to expansion capabilities and included peripherals. Suffice it to say, at least for the time being, that this hodge-

podge reflects the continuing uncertainty about precisely what will stir the computer industry's very own sleeping giant—the tens of millions of families that have thus far declined to give a PC a home.

Of course, these five home machines do share a few salient characteristics. First, all or most will be available through department stores or electronics outlets, not only computer retailers. This is nothing new for Tandy, which has been selling computers through its Radio Shack outlets for years. The HeadStart machines, now manufactured and marketed by Philips Consumer Electronics Co., have also been sold through electronics stores in the past. Buyers may be pleasantly surprised, however, to find IBM's PS/1 on the shelves at stores such as Sears and Dillards. The Laser Technologies machine can also be found at Sears and, according to the company, through a mail-order offer via American Express.

Other similarities result from the filter we used to determine which machines to include in this roundup. Because it stands to reason that a machine for general home use must shield novices from the frustrations of DOS, we eliminated every system that doesn't employ some sort of DOS shell or graphical user interface. Because home-computer buyers will expect to get immediate use out of their PCs without dishing out hundreds of additional dollars for software they know nothing about, we eliminated machines that don't come with at least a few modest applications. Because system configuration and

software installation stand among the more-intimidating challenges that novices face, we eliminated systems that don't come preconfigured and preloaded or with software that handles those chores automatically.

That even five machines met our rather stringent conditions seems notable in itself. At this time last year, one would have been lucky to find more than two systems targeting the home audience so aggressively. And more are coming. A few machines that otherwise fit our profile didn't make it into this roundup because they weren't ready in time for our deadline.

None of the five systems that survived our filter is likely to appeal to all home-computer buyers. On the other hand, most do a reasonably good job of realizing one vision of what a home computer should be, and each is at least reasonably well built and well backed. Whether you're looking for a home computer for your own family or playing consultant for a friend, you're likely to find a machine in the following pages that is up to the task.

■ Our first-ever roundup of home PCs examines five systems: the IBM PS/1, the Laser Pal 286, the Magnavox HeadStart 500 CD, the Sun Moon Star 286-12 CD, and the Tandy 1000 RL.

thoughtful innovations, for the aggressive support it is offering with this machine, and for sparking renewed interest in the home market. Whether a given shopper should buy a PS/1 depends on how little machine he is prepared to live with, and how important he deems the IBM label.

Pricing for the 286-based PS/1 begins at \$999 for a complete system, which includes 512K RAM, one 1.44MB floppy, a black-and-white VGA display, an internal, 2,400-bit-per-second modem, and a two-button mouse. At its top configuration, which adds another 512K RAM, a 30MB hard disk, and a color VGA monitor, the system carries a retail price of \$1,999.

Bundled software includes DOS 4.01, the PS/1 DOS shell, *Microsoft Works*, and access programs for three online systems, including Prodigy.

Getting up and running with the PS/1 is notably easy and fast. The system unit, 12-inch monitor, and all accessories come neatly packed in one box, and system installation is about as close to fool-proof as it gets. The brief getting-started manual does a nice job of illustrating cable connections, and the machine comes

CONTINUES

IBM PS/1



IBM's PS/1 has been thoughtfully designed to take up an absolute minimum of precious desk space.

Whatever the fate of the IBM Personal System/1, IBM deserves credit for a handful of

After Hours

Home PCs

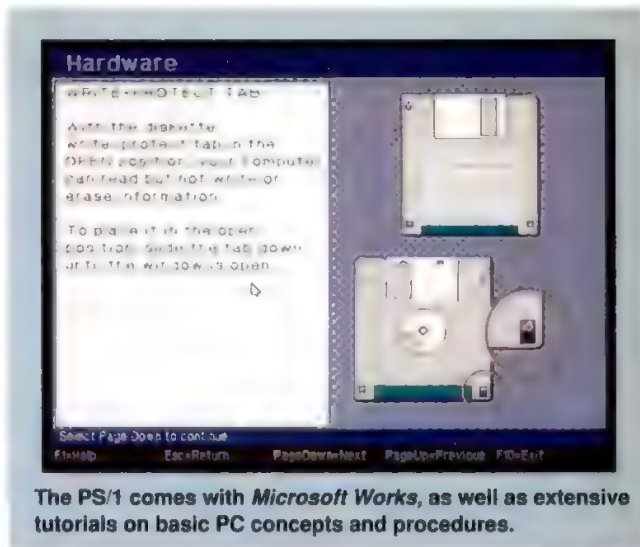
CONTINUED

with DOS, BASIC, and the PS/1 DOS shell loaded in 256K of ROM. With hard disk models, *Microsoft Works* and the on-line access software come preloaded onto the hard disk. Including time spent reading the instructions, it took us less than 10 minutes to install the PS/1, from unpacking the box to flipping on the power switch.

Those who have installed a PC or two in their day will immediately notice a significant departure from traditional PC design, and one that may not thrill them. IBM built the system speaker and power supply into the monitor, which also accommodates the single system power switch and AC cord. The monitor connects to the processor unit with a standard VGA connector and another D-shell connector, which provides the necessary power.

While it's tempting to fuss at IBM for ensuring the sale of its own monitors, an accusation that isn't totally unfounded, this design does, on the whole, seem to work to the user's advantage. The monitor must sit squarely atop the system, with no hope of tilting or swiveling, but having a single power switch and AC cord is convenient. You'll also find a headphone jack and system sound volume control (both significant features in a home machine) at the front of the monitor. Finally, eliminating the power supply from the system unit enabled IBM to keep system unit size to a mere 3.1 by 10.75 by 14.4 inches (HWD).

Unfortunately, IBM also omitted expansion slots and skimped a bit on connectors to keep required desktop space to a minimum. Aside from the two monitor connectors, you'll find a mouse port, keyboard port, phone-cord jack, and parallel port on the rear panel, but no serial or game port. IBM partially mitigates this shortcoming by offering a few interesting



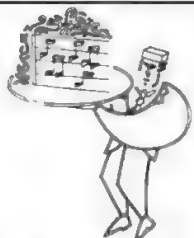
The PS/1 comes with *Microsoft Works*, as well as extensive tutorials on basic PC concepts and procedures.

options that install in proprietary connectors on the system board. The \$129 IBM Audio Card furnishes a MIDI interface and a joystick connector, and an external \$169 IBM Adapter Card Unit adds three standard 16-bit slots. Having to add an expansion chassis might be somewhat irksome, and it will also partially negate the space savings of the

downsized PS/1 system unit, but at least the capability is there should you need it.

Once you've connected the few cables and pushed the power switch, the first screen you'll see is IBM's bold, colorful System Menu. The screen allows entry into four different modules, titled Information, IBM DOS, Micro-

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After Hours

Home PCs

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soft Works, and Your Software. The Information section provides access to the system tutorial, the extensive *Microsoft Works* tutorial, Prodigy, and the User's Club, which offers on-line help and other services to PS/1 owners. The IBM DOS section allows selection of easy file maintenance routines as well as full access to DOS.

The Your Software section looks a bit too much like it was designed for a preschooler, but its folder/paper analogy does a nice job of relaying the idea of subdirectories and files. You still have to go to the DOS section if you want to create a subdirectory, copy files, and so on, but this screen makes it easy to find and execute programs with a few clicks of the mouse.

IBM is peddling this machine as the perfect home PC for the whole family. For example, one

line from the IBM press release reads: "[The] PS/1 makes it possible for all members of the family to use their time more productively—to gather information, to bring work home or run a business from home, to learn, to keep track of family

most of us pounding the desktop in no time. The machine does not support a math coprocessor, and the only way to upgrade to more than 1MB of RAM is by adding a memory board into the optional expansion chassis. Without the expansion chassis,

we would like to have had in the first place, much less a \$129 option to gain a joystick port.

In addition, while IBM has done a nice job of providing an easy user interface in its PS/1 DOS shell and a powerful integrated program in *Microsoft Works*, it has declined to provide the kind of simple, novice-oriented applications that can help computer-wary souls get immediate use out of a system. A module like Tandy's Home Appliances (see the review of the Tandy 1000 RL in this story) would be a perfect addition to a machine of this nature.

On the upside, the price of the PS/1 is not bad, the machine is well constructed, and IBM appears to be doing an excellent job of supporting the system. The company is operating its own banks of toll-free lines to support the PS/1 and promises immediate shipment of any necessary replacement parts. The standard warranty is one year on parts and labor. In addition, the User's Club provides 18-hour-

CONTINUES

The PS/1 User's Club provides 18-hour-a-day on-line help, and another PS/1 on-line service—Promenade—offers user's forums.

finances, or to just have fun."

As much as one would like to believe that assertion, the painful truth is that the PS/1 falls far short of being a machine most experienced users will want to bring serious work home to. The 80286 processor is capable enough for many current business applications, but the system's 10-MHz speed would have

which allows you to add a standard serial port, you'll also have to use the parallel port to transfer files to or from a laptop.

As for its other uses, results are mixed. Anybody who buys a computer should be concerned about expansion capability, and very few of us will be thrilled with the idea of purchasing a \$169 option to gain three slots

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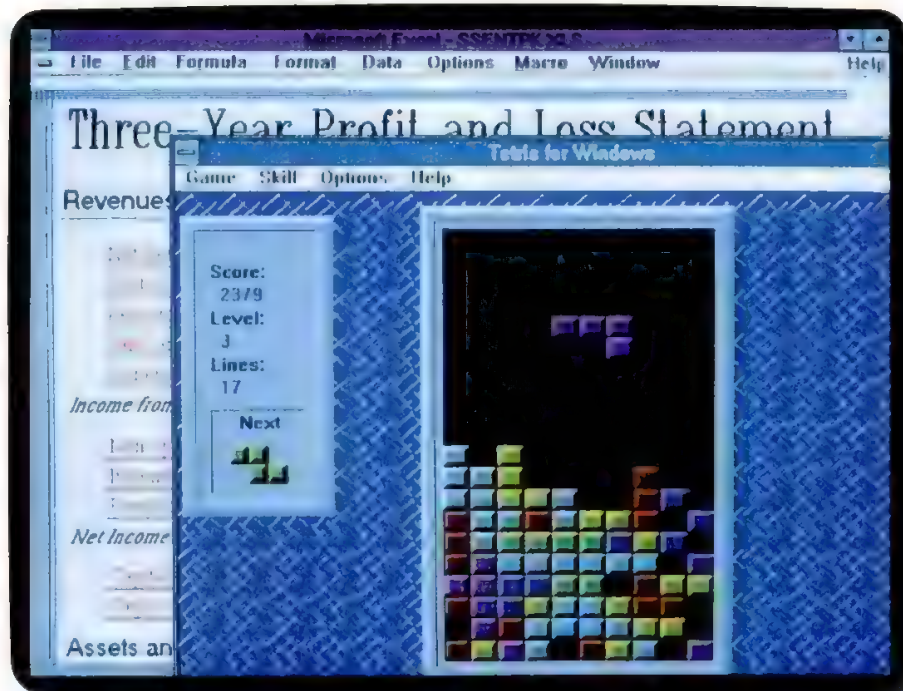
Products listed in alphabetical order

	IBM Corp. IBM PS/1	Laser Computer Inc. Laser Pal286	Philips Consumer Electronics Co. Magnavox HeadStart 500 CD	Sun Moon Star Sun Moon Star 286-12/CD	Tandy Corp. Tandy 1000 RL
Operating speeds	10 MHz	12 MHz, 8 MHz	16 MHz, 8 MHz	12 MHz, 8 MHz	9.54 MHz, 4.77 MHz
Microprocessor	80286	80286	80386SX	80286	8086
Price of tested configuration	\$1,999.00	\$1,995.95	\$3,498.00	\$2,595.00	\$1,455.85
HARDWARE					
Dimensions (HWD, in inches)	3.1 x 10.8 x 14.4	5.1 x 14 x 15	5.6 x 14.4 x 15	4.1 x 17.5 x 16.5	3.1 x 14 x 15
System BIOS manufacturer	IBM	AMI	Philips	AMI	Phoenix
Chip set	VLSI	Discrete logic	C&T	VLSI	Tandy
Coprocessor supported	None	80287	80387SX	80287	None
Motherboard RAM (installed/maximum)	1MB/1MB	1MB/4MB	2MB/8MB	1MB/4MB	768K/768K
Hard disk manufacturer	IBM	Seagate	Rodime	Western Digital	Seagate
Disk capacity	30MB	40MB	80MB	40MB	20MB
Floppy disk drives	1.44MB	1.44MB, 1.2MB	1.44MB	1.2MB	720K
Manufacturer	Mitsubishi	Chinon	Epson	TEAC	TEAC
CD-ROM drive	None	None	Sony CDU-510-12	Hitachi CDR-3600U	None
Video resolution	VGA	VGA	VGA	VGA	Hi-res CGA
Controller on motherboard	■	□	□	□	■
Controller can be disabled	□	■	■	■	■ (with 8-bit IBM-compatible VGA card)
Modem	2,400 bps	2,400 bps	2,400 bps	None	None
Keyboard (style, cable length)	101-key, 72 inches	102-key, 60 inches	101-key, 84 inches	101-key, 72 inches	101-key, 72 inches
Mouse	2-button	3-button	3-button	3-button	None
SYSTEM CONTROLS					
Keyboard lock	None	Front	None	Front	None
Power switch	Front	Back	Front	Front	Front
Reset switch	None	Front	None	Front	None
Turbo button/indicator	None/None	Front/2-digit LED	None/None	Front/Front	None/None
EXPANSION					
I/O ports	1 parallel, 1 serial, 1 mouse, 1 external floppy disk drive	1 parallel, 2 serial, 1 game	1 parallel, 2 serial	1 parallel, 2 serial	1 parallel, 1 serial, 1 mouse, 2 game
Expansion slots	2 proprietary	4 16-bit	1 8-bit, 4 16-bit	3 16-bit	1 8-bit
Slots free in fully configured PC*	1 proprietary	2 16-bit	1 16-bit (with CD-ROM card installed)	None (with CD-ROM card installed)	1 8-bit
Drive bays	Two 3.5-inch	One half-height, two 3.5-inch	One half-height, two 3.5-inch	Two half-height, two 3.5-inch	Two 3.5-inch
SOUND AND MUSIC					
Music capability	Single-voice analog	Single-voice analog	Single-voice analog, CD audio	Single-voice analog, CD audio	3-voice digital with sampling
I/O jacks	Headphone	None	Headphone, 2 RCA	Headphone	Microphone, headphone
User interface	IBM PS/1 DOS shell	GeoWorks Ensemble	HeadStart Environment	GEM/3 Desktop	DeskMate
On-line tutorial/help	■ / ■	□ / ■	□ / ■	□ / □	■ / ■
Software installation	Preloaded and configured	Automatic	Automatic (CD-based)	Automatic (CD-based)	Preloaded and configured
SERVICE AND WARRANTY					
Standard warranty	1 year	1 year	1 year	12 months hard disk, 18 months CD-ROM drive, 3 years other parts	1 year
Service	Express parts swap; on-site service	Express parts swap; on-site service	6 months on-site, then return to dealer or service center	6 months on-site, 6 months return to depot; express parts swap	Return to service center
Toll-free telephone support	■	■	■	■	■ (local centers)
BASIC CONFIGURATION					
Base price	\$999.00	\$1,995.95	\$2,499.00	\$1,395.00	\$599.95
Departures from tested configuration	512K RAM; no hard disk; mono VGA monitor	None	1MB RAM; extra 1.2MB floppy disk drive; no monitor, CD-ROM, or CD-based software	Mono monitor; no CD-ROM or CD-based software	512K RAM; no hard disk, monitor, or system clock

■—Yes □—No

* With hard and floppy disk drives, video, and 1 parallel, 2 serial,
and 1 game port (or 1 serial port and a mouse connector) installed.

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Home PCs

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a-day on-line assistance, and another exclusive PS/1 on-line service—Promenade—offers user's forums, live PS/1 tutoring sessions, interactive games, and an on-line encyclopedia.

All in all, the Personal System/1 seems to be ill suited for

PS/1

IBM Corp.; contact an authorized IBM dealer for information, or call (800) IBM-2468.

List Price: With 512K RAM, 1.44MB 3.5-inch floppy disk drive, black-and-white VGA display, internal 2,400-bps modem, two-button mouse, one parallel and one mouse port, headphone jack, IBM PS/1 DOS shell, *Microsoft Works*, Version 2.0, Prodigy startup kit, DOS 4.01, \$999; with color VGA

LASER PAL286



Like IBM's PS/1, the compact Laser Pal286 arrives in a single box.

If you pass through Sears Brand Central to check out the IBM PS/1, don't overlook the Laser Pal286. This 12-MHz, 286-based system promises to do a good job of accommodating experienced users. It comes with four expansion slots, one year of on-site service, and *GeoWorks Ensemble*, the new graphical user interface that makes *Windows 3.0* look and feel a bit antiquated.

The Laser Pal286 is available in a single configuration and lists for \$1,995.95. That sum

buys you 1MB of RAM, a 43MB IDE hard disk, a 1.44-MB floppy drive, a 1.2MB floppy drive, a 14-inch color VGA display, a 2,400-bps modem, a three-button mouse, DOS 4.01, *GeoWorks Ensemble*, and a Prodigy startup kit. Standard equipment includes one parallel and two serial ports, and one game port.

Laser Computer has gone to more trouble than most manufacturers to ensure that novices will have no problems during setup. In addition to the well-done *Quick Start Guide*, the company provides a professional-quality, 12-minute VHS tape that does an excellent job of leading the viewer through system setup.

The automatic software installation routine requires only that you insert the first 1.44MB floppy disk, turn on the machine, hit return, and insert the second disk when prompted. Setup

CONTINUES

Laser has gone to more trouble than most to ensure that novices will have no problems during setup.

those very experienced with PCs and those terribly scared of them. But a novice who's willing to put some effort into learning software will probably be thrilled with the PS/1's size, on-line services, sharp VGA graphics, and IBM's vigorous support.

display, \$1,499; with 1MB RAM, 30MB hard disk, \$1,999.

In Short: This 10-MHz, 286-based system is too slow and limited for most experienced PC users but represents a good value for the eager novice.

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should take no more than half an hour.

Each time you turn on the system, you'll be greeted by the bold, attractive *GeoWorks Ensemble* welcome screen. The screen allows access to three modules, dubbed Appliances, Professional, and DOS Programs. The Appliances module is intended for novices and includes a simple calculator, address book, planner, and notepad. DOS Programs allows access to DOS standard applications by clicking on icons, which the program and documentation make easy to install.

The Professional section looks a bit like a slicker version of *Windows 3.0*. Unlike *Windows*, however, *Ensemble* treats nearly everything like an object, including the pull-down menus; you can "pin open" a menu, for instance, and then drag it to any spot on the screen. Of course, you can copy files and subdirectories by moving their icons to the appropriate disk or folder.

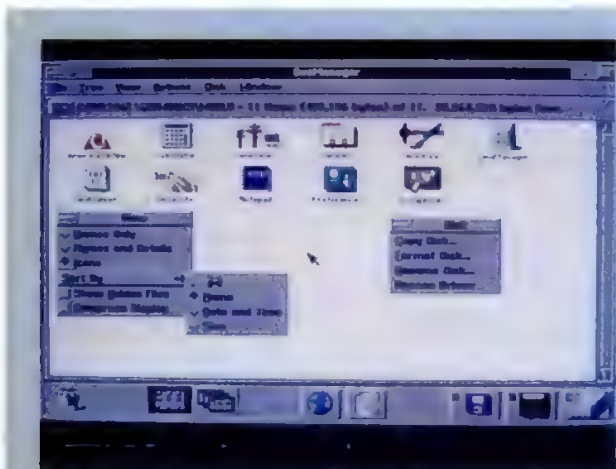
Though not yet released as a separate product at the time of our evaluation, *GeoWorks Ensemble* has already received early acclaim for its ability to run in as little as 512K, its PostScript-like font capabilities, its speed of operation, and its promise to support multithreading even on

8088-based machines. Despite its innovative design, this interface will be useful primarily for its file-management capabilities and integrated applications, until software vendors begin shipping *Ensemble*-compatible applications. The applications integrated into the Professional module include more-complex versions of the four appliances, a communications program, a word processor, and a drawing program.

The Pal286 itself is a small-footprint model that measures 5.1 by 14 by 15 inches (HWD). All three drive bays in our machine were filled, two with floppies and one with the 3.5-inch Seagate hard disk. All other components are made by Laser or its parent company, Video Technology, including the substantial, click-action keyboard. The motherboard accommodates as much as 4MB of 80-nano-second RAM via SIMMs and supports installation of an 80287 math coprocessor. The internal modem and 16-bit VGA controller each occupied one of the four horizontal slots, leaving two 16-bit slots open. All I/O ports originate on the motherboard and can be disabled or remapped. Finally, the system employs an AMI BIOS and supports both system and video BIOS shadowing, though both were disabled in the default configuration.

Our complaints with this system were few but notable. The

CONTINUES



The Laser Pal286 comes with the *GeoWorks Ensemble* operating environment, which allows live objects such as menus to be placed anywhere on-screen.

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system unit feels solid and looks good from the outside, but the chassis cover is just a bit thinner than we would have liked and somewhat difficult to put back on. As with most reasonably well-made, low-cost clones, this is more of an irritation than a serious problem.

The chassis cooling vents provide the next bit of fodder for complaint. Laser built the vents into the top panel of the computer's chassis cover, near the rear. The *Quick Start Guide* and setup video caution the user against blocking these vents with the tilt-swivel stand of the monitor, but it's easy to imagine the monitor getting pushed toward the back of the machine over time.

Another problem involves the monitor itself. At brightness levels sufficient to yield attractive colors, the screen was consistently blurry, a particularly bad problem when trying to read screen text. Adjusted to keep the fuzziness to a minimum, the

screen was dim and dull. The monitor also reflected glare far more than the monitors shipped with the other machines we reviewed. Laser would be wise to address these complaints.

As with the other machines reviewed here, the decision of whether to buy the Pal286 should boil down to a question of what is most important to the home-computer buyer.

A shopper concerned with speed and expandability will appreciate the Pal286's dual floppy disk drives, four slots, 4MB RAM capacity, and math co-processor support. For those wary of lifting a screwdriver, the one year of on-site service through Dow Jones will be a plus. The Pal286 does a bit of a better job than the PS/1 in providing at least some sort of novice-oriented software—the four *Ensemble* appliances—but these don't even come close to being as useful, easy to use, or extensive as those supplied with the Tandy.

The Laser Pal286 seems most appropriate for an eager novice who wants a bit of growing room or for a relatively experienced PC user looking for an inexpensive home machine. Again, how-

ever, look over the monitor before you buy.

Laser Pal286

Laser Computer Inc., 800 N. Church St., Lake Zurich, IL 60047-1596; (708) 540-8911.

List Price: With 1MB RAM, 43MB hard disk, 1.44 3.5-inch and 1.2MB 5.25-inch floppy disk drives, color VGA display, internal 2,400-bps modem, three-button mouse, one parallel and two serial ports, one game port. *GeoWorks Ensemble*, Prodigy startup kit, DOS 4.01.

In Short: With its 12-MHz 80286 performance, reasonable level of expandability,

GeoWorks Ensemble interface, and one year of on-site service, this machine should appeal both to experienced users and eager novices. The major problem was a troublesome monitor.

CIRCLE 614 ON READER SERVICE CARD

MAGNAVOX HEADSTART 500 CD



With its internal CD-ROM drive and 80386SX processor, the HeadStart 500 CD has power and storage to spare.

If you're looking for as little home PC as you can get by with, skip over the Magnavox HeadStart 500 CD. This 16-MHz, 386SX machine offers plenty of power, plenty of room for growth, and a bundle of disk- and CD-ROM-based software that will keep the most energetic explorer busy for months.

Of course, you can also play standard compact disks on the CD-ROM drive while you work—and listen with the included headphones—a feature sure to endear this home PC to just about anybody who has the money to buy it.

The 500 CD carries a list price of \$2,999, which includes a Super VGA-capable analog/digital adapter but not a monitor. If you opt for the VGA monitor we requested with our evaluation unit, the price jumps to \$3,498. While this is well above the price you can expect to pay for any other home machine reviewed here, the 500 CD represents one of the best values you'll find—given the hardware and software provided—in or out of the home-computer niche.

The machine, which measures 5.6 by 14.4 by 15 inches (HWD), comes with 2MB RAM, an 80MB IDE hard disk, a 1.44MB floppy drive, a Sony internal CD-ROM drive, the 16-bit Philips video adapter, a 2,400-bps modem, a three-but-

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EDITORS' CHOICE

After running games, benchmark tests, and all the software bundled with these five machines, it's clear that no single system meets the needs of everyone likely to boot up a PC at home.

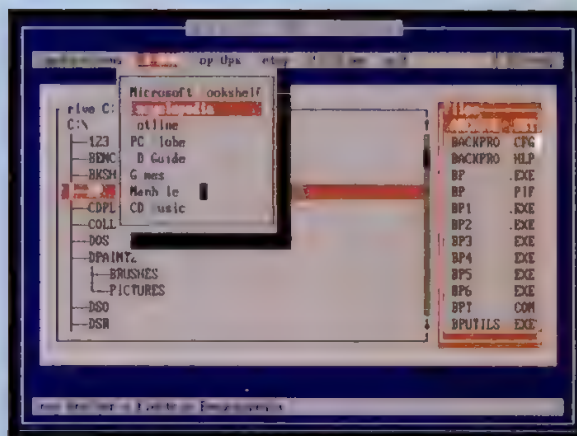
Three of the five systems—the IBM PS/1, the Magnavox HeadStart 500 CD, and the Tandy 1000 RL—distinguish themselves in one way or another and they're all equally deserving of at least an honorable mention.

But they all represent tradeoffs: Tandy provides great software for the home, but poor graphics and little processing power. IBM designed an easy-to-learn system with excellent service support, but little in the way of amenities (sound and

game ports are extra).

And the Magnavox HeadStart is a terrific value for the forward looking. With a 386SX processor, VGA, and a CD player, the HeadStart is an ambitious package that suffers from a weak shell program and a high price.

The definitive home machine has yet to be designed. Our definition of an Editors' Choice PC would include built-in digital sound, a CD-XMA drive, game ports, VGA graphics and, ideally, MIDI support. It would also have a shell along the lines of IBM's PS/1 or *GeoWorks Ensemble* and would be sold by a company that was ready to answer users' questions seven days a week, including holidays.



The Magnavox HeadStart 500 CD comes with a character-based operating environment that mimics graphical front ends.

After Hours

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ton mouse, and one serial and two parallel ports. On the slot bracket of the CD-ROM interface board, you'll find a headphone jack, a volume control, and two RCA jacks, which can be used to connect the CD-ROM drive to your stereo or to self-amplified speakers. Memory is expandable to 8MB on the motherboard using 1Mbx9 SIMMs, and the internal modem, video adapter, and CD-ROM interface leave two 16-bit slots open for upgrades. The one-year warranty provides for six months of on-site service through General Electric Computer Service centers and six months of carry-in service.

The seemingly endless list of bundled software begins with a number of good to excellent packages that install on the hard disk. In addition to DOS 4.01, GW-BASIC, the HeadStart Environment, and the Prodigy startup kit, you get Borland's *Quattro* 1.0, Symantec's *Q&A* 3.0, Timeworks' *Publish-It!*, Electronic Arts' *Deluxe Paint II*, Design Software's *Word for Word Professional* 4.1, and Software Toolworks' *Mavis Beacon Teaches Typing*, *Backup Pro*, *Twist & Shout*, *DS Optimize*, and *DS Recover*. Most of these programs are provided in their most recent versions or close to it, with the one notable exception being *Quattro* 1.0, which has been significantly improved upon with the brand new *Quattro Pro*.

This selection of applications amounts to as varied and as useful a cross section of DOS software as you are likely to find offered on any entry-level system now on the market.

The news only gets better with the CD-based software. To begin with, all of the above software comes on the HeadStart Software Backup disk, which makes the automatic software installation a breeze. To get started with the installation procedure, you insert the HeadStart master disk into the A: drive and turn on the machine.

The routine prepares the hard disk, prompting you to hit Enter a few times in the process, then asks you to insert the Software Backup disk. The system copies the software to the hard disk and configures the system without further intervention.

The entire process, including hardware setup—which was adequately explained and illustrated in a step-by-step quick start card—should require about an hour, including the time it will take a novice to find and read the instructions on inserting a CD into the caddy.

The CD-based software includes *Microsoft Bookshelf*, the *New Grolier Electronic Encyclopedia*, General Information Systems' *Hot Line II*, PC Globe's *PC Globe*, WGE Publishing's *CD Guide Optical Edition*, a collection of 30 games, and Polygram's *Music CD Sampler*. Just in case you've forgotten,

Microsoft Bookshelf alone comprises the *American Heritage Dictionary*, *World Almanac and Book of Facts*, *U.S. ZIP Code Directory*, *Bartlett's Familiar*

base of thousands of music compact disks.

The HeadStart Environment itself, which runs in character mode, lacks the polish of the

The HeadStart 500 CD offers power, room for growth, and a bundle of software that will keep the most energetic explorer busy for months.

Quotations, *The Chicago Manual of Style*, 13th Edition, *Roget's II: Electronic Thesaurus*, *Houghton Mifflin Spelling Verifier and Corrector*, *Houghton Mifflin Usage Alert*, and *Forms and Letters*. The *CD Guide Optical Edition* includes, among other things, reviews and a data-

PS/1 DOS shell and the Laser machine's *GeoWorks Ensemble*, and users may be confused initially by a few idiosyncrasies, but it does a fine job overall of shielding novices from the inanities of DOS. To copy files, for instance, you simply choose

CONTINUES



BENCHMARK TESTS: HOME PCs

For this roundup of home PCs, we ran a special subset of the *PC Magazine* benchmark tests to emphasize disk, video, and basic computing speeds only.

In comparing the machines, it's important to remember that there are drastic differences among the clock speeds and processors. The IBM PS/1 and the Tandy 1000 RL run at nearly the same speed, but the IBM uses a 286 and Tandy uses an 8086; only the Laser Pal286 and Sun Moon Star 286-12/CD run the same processor at the same speed (a 286 at 12 MHz). The Magnavox HeadStart 500 CD has the best processor in the pack; it runs a 386SX at 16 MHz.

8088 Instruction Mix

The 8088 Instruction Mix benchmark test times a series of tasks specific to the 8088 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.

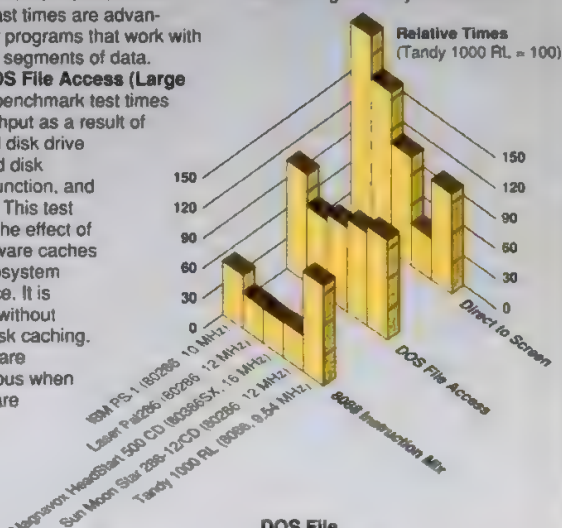
For this group of machines we ran only the 8088 Instruction Mix test to get comparable results across the different processors.

The DOS File Access (Small Records) benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.

The DOS File Access (Large Records) benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded.

The figure reported for each machine is the sum of the results for large- and small-file access.

The Direct to Screen benchmark test indicates the speed of the video adapter memory. Good scores indicate that information can get to the screen quickly, particularly for programs that avoid the computer's BIOS and go directly to the screen.



Performance Times

(Times given in seconds)
(Smaller numbers represent better performance)

IBM PS/1 (80286, 10 MHz)	7.32
Laser Pal286 (80286, 12 MHz)	4.89
Magnavox HeadStart 500 CD (80386SX, 16 MHz)	4.82
Sun Moon Star 286-12/CD (80286, 12 MHz)	4.96
Tandy 1000 RL (8086, 9.54 MHz)	13.73

8088 Instruction Mix	DOS File Access (Total, Small and Large Records)	Direct to Screen
7.32	113.26	6.81
4.89	80.71	5.39
4.82	87.84	3.68
4.96	97.29	1.43
13.73	104.90	3.41

After Hours

Home PCs

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the appropriate directory from a tree, mark the appropriate files, invoke the copy command via menu or the keyboard shortcut, and either type in the destination or mark it on the tree.

To start an application, you

ingly dislodged the battery leads partially from their motherboard connection. The resulting problem would have been a nightmare for most novices, and the documentation addresses neither CMOS battery failure nor how to recover from it.

Another problem appears to have arisen when we disturbed the careful routing of the ribbon cables inside the machine. An hour or so after we replaced the

simply want the 286 machine without the CD package, you'll pay \$1,999. This is still a pretty good deal given all the included disk-based software, but the machine isn't nearly as compelling without the CD package.

It's difficult not to like the Magnavox HeadStart 500 CD, despite its few problems. Computer-wary novices might find the sheer volume of software a bit intimidating, and our complaints with the documentation and system should be kept in mind. For experienced users and ambitious novices, however, this machine includes everything one could reasonably ask for in a machine at this price, with the notable exception of a game port. The CD bundle and disk-based applications make the 500 CD a bargain for students, home professionals, or anybody else who wants unlimited access to so much software and information.

Magnavox HeadStart 500 CD Philips Consumer Electronics Co., One Philips Dr., P.O. Box 14810, Knoxville, TN 37914-1810; (800) 882-1888.

List Price: With 1MB RAM, 80MB hard disk, 1.44 3.5-inch floppy disk drive, Super VGA adapter, internal 2,400-bps modem, three-button mouse, one parallel and two serial ports, HeadStart Environment, Prodigy startup kit, *Quattro 1.0*, *Q&A 3.0*, *Publish-It!*, *Deluxe Paint II*, *Twist and Shout*, *Mavis Beacon Teaches Typing*, *DS Recover*, *DS Optimize*, *Backup Pro*, *Word for Word Professional 4.1*, DOS 4.01, \$2,499; with 2MB RAM, internal CD-ROM drive, *Microsoft Bookshelf*, *The New Grolier Electronic Encyclopedia*, *Hot Line II*, *PC Globe*, *CD Guide Optical Edition*, *CD Music Sampler*, 30 games, \$2,999; with color VGA monitor, \$3,498.

In Short: Though not without its faults, this 16-MHz 386SX machine offers ease of use, plenty of power, and an extraordinary collection of software in its value-packed CD-ROM configuration.

CIRCLE 618 ON READER SERVICE CARD

SUN MOON STAR 286-12/CD



The Sun Moon Star system unit has a sleek, low-slung look. The system's CD-ROM package is also available separately.

The folks at Sun Moon Star apparently know a good thing when they see it. The company has not only followed the lead of Philips' Magnavox HeadStart machines by bundling a CD-ROM drive and CD-based software with its system but also has used the services of the same company, Software Toolworks, for the automatic installation routine and other systems integration needs. Unfortunately, while the 12-MHz 286-based system itself is admirably constructed and the CD bundle is impressive, the package as a whole seems to have been rushed to market a bit prematurely. The owner's guide is so out of date as to be virtually useless. Configured with the CD-ROM drive, the machine also leaves little room for expansion.

Sun Moon Star announced a \$400 drop in price during the course of this evaluation, down to a list price of \$2,595. That figure buys you 1MB of RAM, a 43MB IDE hard disk, a Hitachi internal CD-ROM drive, a 1.2MB floppy drive, a color VGA display, a three-button mouse, and one serial and two parallel ports. The CD-ROM drive has a headphone jack (headphones aren't included) and volume control on its front panel. Motherboard memory can be expanded to 4MB via 80-nano-second, 1Mbx9 SIMMs.

As with the Magnavox HeadStart machine, bundled software includes a healthy selection of both disk-based and CD-based packages. The disk-based software includes DOS 3.3 and GW-

CONTINUES

The Sun Moon Star is admirably constructed, and the CD bundle impressive, but the package seems to have been rushed to market.

pull down the applications menu and choose the name of the program. You can add or delete a program from the list through an easy-to-use menu.

The HeadStart documentation includes a few handy quick reference guides plus 10 paperback volumes, which cover the system and the bundled software. Philips has done a nice job of matching the bindings of the volumes, so they look nice sitting on a shelf, but the content could use some work—especially given the intended audience. The troubleshooting section, for instance, is only six short pages long, and concepts such as directories are mentioned with little or no explanation. Some of the volumes lack an index or offer only a skeletal one; that's frustrating when one is dealing with so much information. The main selling point of systems like this is that they not only provide the tools, but also make them accessible to a wide audience. The HeadStart is almost, but not quite, there.

We also had some complaints with the system itself. The wire leading to the Lithium CMOS backup batteries looped around the back of one of the slot edge-connectors and was installed with virtually no slack. At some point during our tour of the machine's innards, probably when we reinstalled the adapters, we unknow-

chassis cover, the system became so overheated that it refused to reboot until it had cooled down. After removing the cover and discerning the problem, we were able with some difficulty to push the cables far enough out of the way to allow sufficient air flow.

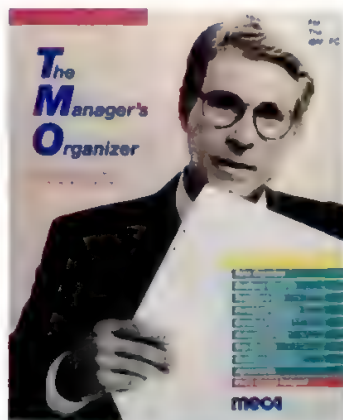
In all fairness, most novices aren't going to start digging around inside the computer any time soon, and even if they did have such problems, they could presumably get quick answers by calling the toll-free number printed in the manual. The six months of on-site service would also be of help. Even so, no home-computer buyer should have to deal with problems that are so easy to avoid.

This review wouldn't be complete without mentioning what are essentially additional configurations of the machine, though none of them offer quite the value of the 500 CD. For instance, if you want the basic 386SX machine without the CD-ROM drive and CD-based software, you'll pay only \$2,499, but this \$500 drop in price also costs you 1MB of RAM. If you're willing to put up with a 12-MHz 286 machine, you can get the CD bundle for the same \$2,499, but this time you lose 1MB of RAM and half your 80MB hard disk capacity. You also step down from a Super VGA to a VGA adapter. Finally, if you

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Requires: 512K IBM® PC or compatibles. 2 disk drives. Hard Disk recommended. DOS 2.0 or later. Contains both 5.25" and 3.5" versions. Not copy-protected.

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BASIC; *GEM/3 Desktop*, Digital Research's graphical user interface; Digital's *GEM Draw Plus*; Software Publishing Corp.'s *PFS:First Choice*, Version 3.02; *CheckIt*, a diagnostics utility by TouchStone Software

has spent little time providing any sort of comprehensive, up-to-date documentation. The 77-page system operation guide appears to be for the same system chassis, but it makes no mention of the CD-ROM drive or the bundled software. It also gives instructions for working with Digital Research's DR DOS, which apparently once came with the machine. Fortunately, the company preloads the

a list price of \$1,395. This base configuration substitutes a monochrome VGA monitor for the color version shipped with our unit. Even so, the price is a good one, though the machine has little to offer the home-computer buyer once you remove the CD-ROM bundle.

Aside from the CD-ROM bundle, the machine's strongest assets are its all-around sturdy construction, its free 3.5-inch disk bay, and, best of all, its three-year warranty, which includes six months of on-site service followed by six months of carry-in. Sun Moon Star also maintains a toll-free number for technical support.

Unfortunately, the failings of the machine outweigh its virtues. Perhaps Sun Moon Star will issue improved documentation. Perhaps it will also find some way to accommodate the CD-ROM drive and still leave a couple of expansion slots free. In the meantime, you're better off with one of Philips' Magnavox HeadStart models if you want the benefits of the CD-ROM bundle.

Sun Moon Star 286-12/CD
Sun Moon Star, 1941 Ringwood Ave., San Jose, CA 95131; (800) 545-4786.

List Price: With 1MB RAM, 43MB hard disk, 1.2MB 5.25-inch floppy disk drive, monochrome VGA monitor, three-button mouse, one parallel and two serial ports, GW-BASIC, *GEM/3 Desktop*, *GEM Draw Plus*, *PFS:First Choice*, *CheckIt*, and *Twist and Shout*, DOS 3.3, \$1,395; with internal CD-ROM drive, color VGA monitor, *Microsoft Bookshelf*, *Microsoft Small Business Consultant & Stat Pack*, *The Software Toolworks Illustrated Encyclopedia*, *The Software Toolworks World Atlas*, *CD Guide Optical Edition*, *Hot Line II*, \$2,595.

In Short: Though offering a CD-ROM option similar to the Philips' machines at an attractive price, Sun Moon Star's 12-MHz, 286-based entry lacks the expandability and finishing touches of its competition.

CIRCLE 618 ON READER SERVICE CARD

TANDY 1000 RL



Tandy's 1000 RL has a very small footprint, but offers only an 8086 processor.

Watch a prudent mom and dad shop for their first home computer, and you'll probably hear the words salespeople must fear most: "Show me what we can do with this computer."

With Philips' Magnavox HeadStart systems, the salesperson might show the CD applications and even play a bit of music, but he'll eventually have to admit to the rather heady price. With the IBM PS/1, mom and dad will get to see *Microsoft Works*, a very nice package but still business software at heart.

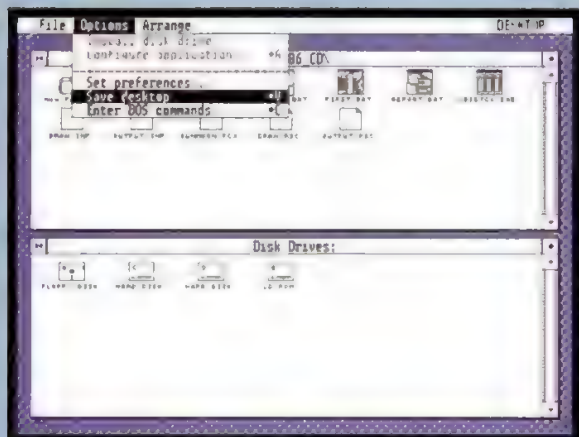
Lo and behold, when they gaze upon the 9.54-MHz, 8086-based Tandy 1000 RL, our hypothetical parents will see a novel and mercifully straightforward collection of home- and personal-management utilities: the Home Organizer.

This new addition to the *DeskMate* environment, available only with the 1000 RL, is part of Tandy's new strategy for success in the home-computer market. IBM believes that the people who want to bring work home from the office will drive home-computer sales in the future. Tandy believes that IBM has got it all wrong, that the "moms of the world" will drive home-computer sales, and that past systems have simply been too difficult to learn.

Unfortunately, the 1000 RL may not be an appropriate test of Tandy's theory: The limitations of this machine may overshadow the best features of the Home Organizer.

Pricing for the Tandy 1000 RL begins at \$599.95, which includes 512K RAM, one 720K floppy, DOS 3.3, *DeskMate*, and

CONTINUES



The Sun Moon Star 286-12/CD employs the familiar GEM interface. The system also comes with a slew of CD-based software.

Corp.; and Software Toolworks' *Twist and Shout*. CD-based software includes *Microsoft Bookshelf*, *Microsoft Small Business Consultant & Stat Pack*, *The Software Toolworks Illustrated Encyclopedia*, *The Software Toolworks World Atlas*, *CD Guide Optical Edition*, by WGE Publishing; General Information's *Hot Line II*, and a collection of 10 games.

At first glance, all this seems to be more than enough, but closer scrutiny reveals a few serious shortcomings. To begin with, the machine omits both a modem and game port. For beginners, the lack of these two options could impede the machine's usefulness.

The Trident VGA card and CD-ROM interface board occupy two of the system's three 16-bit slots. That means you'll have to opt for an external modem if you want to install a game port. It also means that a fax board or any additional option you can think of is out of the question.

In addition, Sun Moon Star

disk-based software and preconfigures the machine, but you won't know this until you turn on the machine (unless, of course, your dealer tells you).

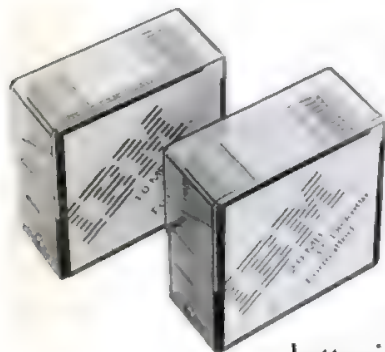
Sun Moon Star also sells the CD bundle as a \$995 external option. The bundle comes with an installation guide and two thick paperback manuals similar to those provided with the Magnavox HeadStart. As with the HeadStart, the information is there, but finding it without an index can get a bit frustrating. Sun Moon Star supplies complete vendor packaging and documentation for each of the disk-based programs.

The *GEM/3* graphical user interface provided with the system makes file management a simple chore once you get the hang of it. Novices may initially yearn for a bit of on-line help or an on-line tutorial, but Digital Research's documentation does a fine job of introducing the interface's humble set of commands.

Sun Moon Star also sells the 286-12 without the CD bundle at

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After Hours

Home PCs

CONTINUED

the Home Organizer. For a jump in price to \$999.95, Tandy adds a system clock and a 20MB hard disk. Our evaluation unit, supplied with Tandy's \$399.95 hi-resolution CGA monitor and the 256K RAM upgrade kit, carried a total list price of \$1,455.85. All configurations include a three-voice digital synthesizer, one parallel port, one serial port, one mouse port, two joystick ports, one headphone jack, one microphone jack, and a volume level control.

The 1000 RL rivals the PS/1 in ease of setup and installation. The machine comes with *DeskMate* and a subset of DOS 3.3 installed in 256K ROM, and Tandy installs the Home Organizer on the hard disk at the factory. Once you've made the appropriate connections, you simply turn on the machine to begin work. We were able to unpack and set up the machine in less than 10 minutes.

The first screen that buyers see when they boot up is *DeskMate*'s Desktop, the central menu screen of the interface. Boxes of various sizes and shapes correspond to *DeskMate* applications that have been preloaded onto the desktop. You can also load your own applications or other *DeskMate* applications onto the desktop by creating a

new box, which is a simple task.

While *DeskMate* lacks the elegance and multi-mode sophistication of *Windows* 3.0, it has been successful as a low-end graphical interface on a variety of Tandy machines. A long list of software vendors support *DeskMate*, which means that adventurous 1000 RL owners can choose from a wide variety of applications beyond those sold

register, a diary (complete with passwords for separate members of the family), and a wonderful collection of simple financial calculation routines. The financial calculation routines, dubbed *MathCard*, allows users to solve any of about 10 financial formulas simply by filling in a few blanks. For instance, if you want to know how expensive a house you can afford, choose Home

CGA graphics—16 colors at a resolution of 640 by 200. While this is unquestionably an improvement over the 320-by-200 resolution of standard CGA, the *DeskMate* screens still look extremely grainy. Worse, when working on the Desktop, we occasionally could not discern which application box was highlighted without hitting Tab and watching for movement. Here again, a mouse would help.

Of course, we also feel compelled to point out the relative inadequacies of the 8086 processor, and to note that the list price seems high for an 8086-based machine. Given the intricate games that are growing in popularity for the PC, even a home machine bought primarily for fun may get bogged down in today's software.

Tandy may be on the right track with its Home Organizer, at least for a certain category of novice. All of us can probably think of friends or family members who would enjoy using a computer purely to catalog the household possessions, store names and addresses, keep track of a checkbook, or file away recipes.

Unfortunately, the limitations of the machine itself—primarily its grainy, high-resolution CGA graphics—make the Tandy package as a whole difficult to recommend, even to a novice. ■

Tandy 1000 RL

Tandy Corp., 1800 One Tandy Center, Fort Worth, TX 76102; (817) 390-3011.

List Price: With 512K RAM, 720K floppy disk drive, three-voice digital synthesizer, one parallel port, one serial port, one mouse port, two joystick ports, one headphone jack, one microphone jack, *DeskMate*, Home Organizer, DOS 3.3, \$599.95; with 20MB hard disk, system clock, \$999.95; with Tandy hi-res CGA monitor, \$1,399.90; with 768K RAM, \$1,455.85.

In Short: Tandy is aiming this 9.54-MHz 8086 machine solely at unsophisticated first-time buyers. The Home Organizer utilities should appeal to even computer-wary novices, but the machine itself is somewhat overpriced and underequipped.

CIRCLE #17 ON READER SERVICE CARD

Tandy's Home Organizer utilities require little or no learning. It's easy to imagine a first-time buyer taking advantage of these canned utilities.

with the machine.

To choose an application represented on the desktop, such as Write, Home Organizer, or Draw, you highlight the appropriate box, by pushing the Tab key, and then press Enter. To run other applications, such as Music—a simple program that lets you create, edit, and play music by moving notes onto the staves—you choose Run from the File menu and choose the appropriate program name.

The Home Organizer, by far the most interesting piece of *DeskMate* software, includes a messaging area, a home inventory database, a catalog of recipes, a shopping list, a checkbook

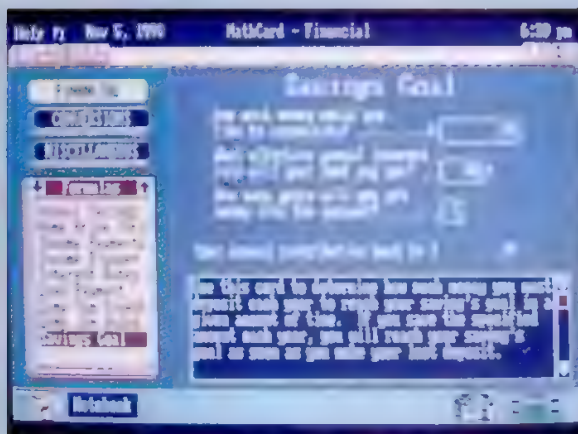
Price Info and enter your planned down payment, your maximum monthly payment, the number of years of your mortgage, and the effective annual interest rate. The program calculates the dollar amount that corresponds to the terms of the loan as you've specified them.

All or most of the Home Organizer utilities require little or no learning, and this is their primary charm. Granted, most *PC Magazine* readers would deny such software even a single cylinder of their hard disk, but it's easy to imagine a first-time buyer thankfully taking advantage of these canned utilities.

Tandy has also implemented a rather unusual, context-sensitive help system geared toward novices. When you press F1 with an object selected, the system presents a list of questions related to the object. When and if you find the question you meant to ask, you highlight it and press Enter to see step-by-step instructions.

Our complaints with this system are numerous and significant. First, while the *DeskMate* interface is simple enough to learn and boasts a few nice features, it is entirely too cumbersome without a mouse, which is conspicuously missing from the list of standard equipment.

Our next complaint, and possibly our most severe, involves Tandy's high-resolution



Unlike the other machines reviewed here, The Tandy 1000 RL sports software that beginners will find immediately useful.

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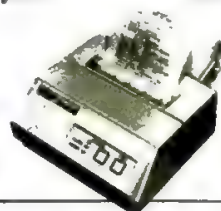
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—Help wanted ad, *ComputerWorld*, September 17, 1990



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If your entry is used in *Abort, Retry, Fail?* we'll send you \$50 and a *PC Magazine* T-shirt. Caution: In case of multiple entries, the postmark date, neatness and completeness of entry are considered. Winners this issue: Earl F. Glynn (DisplayWrite 5), Chris Jones (Radio Shack Virus), Bob Satterfield (CompuAdd support), Larry Guisinger (no experience required), Gary Clevenger (Dial-A-Nerd).



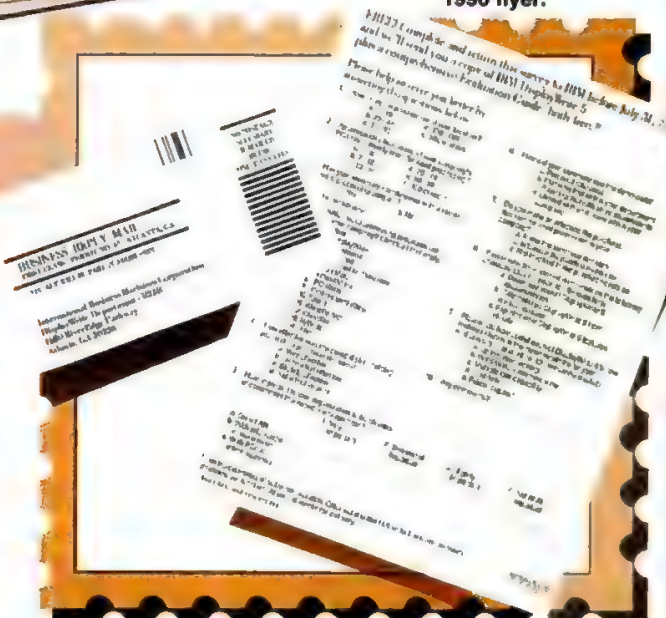
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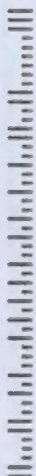


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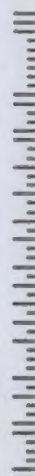


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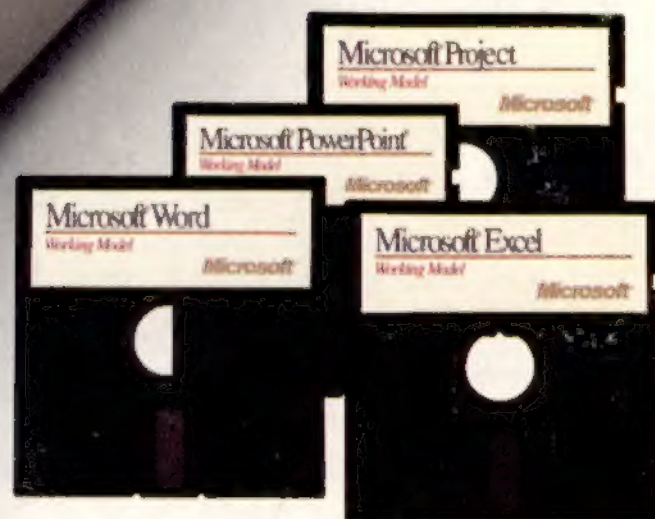


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